

GIVEN THE SEQUENCE OF 3'-TACCTGCGGGATATT-5' ON THE TEMPLATE/ANTISENSE DNA STRAND, WHAT WILL BE THE SEQUENCE

GIVEN THE SEQUENCE OF 3'-TACCTGCGGGATATT-5' ON THE TEMPLATE/ANTISENSE DNA STRAND, WHAT WILL BE THE SEQUENCE

UNDERSTANDING THE RELATIONSHIP BETWEEN DNA STRANDS AND THE RESULTING mRNA SEQUENCES IS FUNDAMENTAL IN MOLECULAR BIOLOGY. WHEN PROVIDED WITH A DNA STRAND SEQUENCE, PARTICULARLY THE TEMPLATE OR ANTISENSE STRAND, ONE CAN DETERMINE THE CORRESPONDING CODING OR SENSE STRAND, AS WELL AS PREDICT THE mRNA TRANSCRIPT THAT WILL BE SYNTHESIZED DURING TRANSCRIPTION. THIS ARTICLE EXPLORES THE PRINCIPLES INVOLVED IN DECODING THE SEQUENCE, ELUCIDATES THE STEP-BY-STEP PROCESS TO FIND THE COMPLEMENTARY AND CODING SEQUENCES, AND DISCUSSES THE BIOLOGICAL SIGNIFICANCE OF THESE SEQUENCES.

UNDERSTANDING DNA STRANDS: SENSE AND ANTISENSE

DEFINITION OF SENSE (CODING) AND ANTISENSE (TEMPLATE) STRANDS

IN THE DOUBLE-HELICAL STRUCTURE OF DNA, TWO COMPLEMENTARY STRANDS RUN IN OPPOSITE DIRECTIONS, KNOWN AS ANTIPARALLEL. THESE STRANDS ARE REFERRED TO AS:

- SENSE (CODING) STRAND: THE DNA STRAND WHOSE SEQUENCE CORRESPONDS TO THE mRNA TRANSCRIPT (EXCEPT FOR THYMINE IN DNA BEING REPLACED BY URACIL IN RNA). THIS STRAND IS OFTEN TERMED THE 'CODING' STRAND BECAUSE ITS SEQUENCE DIRECTLY MIRRORS THE mRNA.
- ANTISENSE (TEMPLATE) STRAND: THE STRAND USED AS A TEMPLATE DURING TRANSCRIPTION BY RNA POLYMERASE. THE mRNA SEQUENCE IS COMPLEMENTARY AND ANTIPARALLEL TO THIS STRAND.

ORIENTATION OF DNA STRANDS

DNA STRANDS ARE READ IN THE 3' TO 5' DIRECTION DURING TRANSCRIPTION, WHICH GUIDES THE SYNTHESIS OF mRNA IN THE 5' TO 3' DIRECTION. THE GIVEN SEQUENCE:

'3'-TACCTGCGGGATATT-5'

IS ON THE ANTISENSE (TEMPLATE) STRAND, WHICH RUNS FROM 3' TO 5'. THE GOAL IS TO DETERMINE:

- THE SENSE (CODING) STRAND SEQUENCE
- THE mRNA SEQUENCE TRANSCRIBED FROM THE TEMPLATE STRAND

DECODING THE COMPLEMENTARY AND CODING SEQUENCES

STEP 1: IDENTIFY THE GIVEN STRAND ORIENTATION

THE PROVIDED SEQUENCE:

'3'-TACCTGCGGGATATT-5'

IS IN THE 3' TO 5' DIRECTION, TYPICAL FOR THE ANTISENSE/TEMPLATE STRAND. TO FACILITATE CALCULATIONS, IT IS OFTEN HELPFUL TO WRITE THE SEQUENCE IN THE 5' TO 3' DIRECTION:

'5'-AATATCCCGCAGGTA-3'

THIS IS THE REVERSE COMPLEMENT OF THE TEMPLATE STRAND AND REPRESENTS THE SENSE OR CODING STRAND.

STEP 2: FIND THE COMPLEMENTARY (TEMPLATE) STRAND

GIVEN THE SENSE STRAND:

'5'-AATATCCCGCAGGTA-3'

THE ANTISENSE (TEMPLATE) STRAND IS COMPLEMENTARY AND ANTIPARALLEL, WITH THE 3' TO 5' ORIENTATION:

'3'-TTATAGG GCGT CCAT-5'

BREAKING IT DOWN:

SENSE (CODING) STRAND	5'-A	A	T	A	T	C	C	C	G	C	A	G	G	T	A-3'

ANTISENSE (TEMPLATE)	3'-T	T	A	T	A	G	G	G	C	G	T	C	C	A	T-5'

NOTE: THE SEQUENCE OF THE TEMPLATE STRAND SHOULD MATCH THE ORIGINAL SEQUENCE WHEN READ IN 3' TO 5' DIRECTION.

STEP 3: CONFIRM THE COMPLEMENTARITY

TO VERIFY, PAIR EACH BASE:

SENSE (CODING)	A		A		T		A		T		C		C		C		G		C		A		G		G		T		A		

TEMPLATE (3')	T		T		A		T		A		G		G		G		C		G		T		C		C		A		T		

THIS CONFIRMS THE COMPLEMENTARY RELATIONSHIP.

DETERMINING THE MRNA SEQUENCE

STEP 1: TRANSCRIPTION RULES

DURING TRANSCRIPTION, THE RNA POLYMERASE READS THE DNA TEMPLATE STRAND IN THE 3' TO 5' DIRECTION AND SYNTHESIZES mRNA IN THE 5' TO 3' DIRECTION. THE BASE PAIRING RULES ARE:

- A (ADENINE) PAIRS WITH U (URACIL IN RNA)
- T (THYMINE) PAIRS WITH A
- C (CYTOSINE) PAIRS WITH G
- G (GUANINE) PAIRS WITH C

STEP 2: TRANSCRIBE THE TEMPLATE STRAND

USING THE TEMPLATE STRAND:

'3'-T T A T A G G G C G T C C A T-5'

MAP EACH BASE TO ITS COMPLEMENTARY RNA BASE:

TEMPLATE DNA	T	T	A	T	A	G	G	G	C	G	T	C	C	A	T
-----	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
mRNA (COMPLEMENT)	A	A	U	A	U	C	C	C	G	C	A	G	G	U	A

THUS, THE mRNA SEQUENCE (READ IN THE 5' TO 3' DIRECTION, COMPLEMENTARY TO THE TEMPLATE STRAND) IS:

'5'-AAUA UCC CGC AGG UA-3'

OR, CONCATENATED:

'5'-AAUAUCCCGCAGGUA-3'

NOTE: SINCE THE ORIGINAL TEMPLATE STRAND IS WRITTEN 3' TO 5', THE mRNA IS SYNTHESIZED 5' TO 3' AS:

'5'-AAUAUCCCGCAGGUA-3'

FINAL mRNA SEQUENCE

THEREFORE, THE mRNA SEQUENCE TRANSCRIBED FROM THE GIVEN ANTISENSE DNA STRAND IS:

'5'-AAUAUCCCGCAGGUA-3'

SUMMARY OF SEQUENCES

- ANTISENSE (TEMPLATE) DNA STRAND: '3'-TACCTGCGGGATATT-5'
- SENSE (CODING) DNA STRAND: '5'-AATATCCCGCAGGTA-3'
- mRNA TRANSCRIPT: '5'-AAUAUCCCGCAGGUA-3'

BIOLOGICAL SIGNIFICANCE OF THESE SEQUENCES

IMPLICATIONS IN GENE EXPRESSION

THE DNA SEQUENCE PROVIDED IS PART OF A GENE'S CODING REGION. UNDERSTANDING THE RELATIONSHIP BETWEEN THE TEMPLATE STRAND AND mRNA HELPS IN:

- DECIPHERING GENETIC INFORMATION
- PREDICTING AMINO ACID SEQUENCES DURING TRANSLATION
- IDENTIFYING MUTATIONS AND THEIR EFFECTS

CODON TRANSLATION AND PROTEIN SYNTHESIS

THE mRNA SEQUENCE IS READ IN TRIPLETS CALLED CODONS, EACH CODING FOR A SPECIFIC AMINO ACID. FOR EXAMPLE:

CODON	SEQUENCE	POSSIBLE AMINO ACID (USING STANDARD GENETIC CODE)
AAU	AAU	ASPARAGINE (ASN)
AUC	AUC	ISOLEUCINE (ILE)
CCG	CCG	PROLINE (PRO)
CAG	CAG	GLUTAMINE (GLN)
GUA	GUA	VALINE (VAL)

THIS ILLUSTRATES HOW THE GENE'S NUCLEOTIDE SEQUENCE DIRECTS PROTEIN SYNTHESIS.

CONCLUSION: FROM SEQUENCE TO FUNCTION

GIVEN THE DNA TEMPLATE STRAND SEQUENCE '3'-TACCTGCGGGATATT-5'', THE COMPLEMENTARY CODING STRAND IS '5'-AATATCCCGCAGGTA-3'', AND THE TRANSCRIBED mRNA SEQUENCE IS '5'-AAUAUCCCGCAGGUA-3''. THESE SEQUENCES FORM THE BASIS FOR UNDERSTANDING GENE EXPRESSION, PROTEIN SYNTHESIS, AND GENETIC REGULATION. RECOGNIZING THE RELATIONSHIPS AMONG DNA STRANDS AND THEIR CORRESPONDING RNA TRANSCRIPTS IS ESSENTIAL FOR MOLECULAR BIOLOGY, GENETIC ENGINEERING, AND BIOTECHNOLOGY APPLICATIONS. THIS KNOWLEDGE ENABLES SCIENTISTS TO INTERPRET GENETIC INFORMATION ACCURATELY AND MANIPULATE IT FOR RESEARCH, MEDICAL, AND INDUSTRIAL PURPOSES.

FREQUENTLY ASKED QUESTIONS

WHAT IS THE COMPLEMENTARY DNA STRAND FOR THE GIVEN SEQUENCE 3'-TACCTGCGGGATATT-5'?

THE COMPLEMENTARY DNA STRAND IS 5'-ATGGACGCCCTATAA-3'.

WHAT IS THE mRNA SEQUENCE TRANSCRIBED FROM THE GIVEN DNA TEMPLATE STRAND 3'-TACCTGCGGGATATT-5'?

THE mRNA SEQUENCE IS 5'-AUGGACGCCCUAUUAU-3'.

WHAT IS THE CORRESPONDING AMINO ACID SEQUENCE FOR THE GIVEN DNA TEMPLATE STRAND?

FIRST, TRANSCRIBE TO mRNA: 5'-AUGGACGCCCUAUUAU-3', THEN TRANSLATE TO AMINO ACIDS: MET - ASP - ALA - LEU - TYR.

WHAT IS THE ANTISENSE (TEMPLATE) DNA STRAND FOR THE GIVEN SEQUENCE?

THE ANTISENSE (TEMPLATE) STRAND IS 3'-ATCCGCGCCTATAA-5'.

IF A MUTATION OCCURS IN THE GIVEN SEQUENCE CHANGING T TO C AT POSITION 5, WHAT WOULD BE THE NEW SEQUENCE?

THE MUTATED SEQUENCE WOULD BE 3'-TACCCGCGGGATATT-5'.

HOW MANY CODONS ARE PRESENT IN THE mRNA TRANSCRIBED FROM THE GIVEN DNA SEQUENCE?

THERE ARE 5 CODONS IN THE mRNA SEQUENCE: AUG - GAC - GCC - CUA - UAU.

WHAT IS THE SIGNIFICANCE OF THE SEQUENCE 3'-TACCTGCGGGATATT-5' IN GENE EXPRESSION?

THIS SEQUENCE SERVES AS A TEMPLATE FOR mRNA SYNTHESIS DURING TRANSCRIPTION, LEADING TO PROTEIN PRODUCTION.

IN WHAT TYPE OF BIOLOGICAL PROCESS WOULD THE GIVEN DNA SEQUENCE BE INVOLVED?

THE SEQUENCE IS INVOLVED IN GENE TRANSCRIPTION AND EXPRESSION PROCESSES WITHIN THE CELL.

CAN YOU DETERMINE THE CODON READING FRAME FOR THE GIVEN SEQUENCE IF IT IS PART OF A GENE?

YES, STARTING FROM THE FIRST NUCLEOTIDE, THE CODONS ARE AUG, GAC, GCC, CUA, UAU, CORRESPONDING TO THE mRNA TRANSCRIBED FROM THE TEMPLATE STRAND.

ADDITIONAL RESOURCES

UNDERSTANDING THE SEQUENCE DETERMINATION PROCESS FROM A DNA TEMPLATE STRAND

DECIPHERING THE RELATIONSHIP BETWEEN A DNA TEMPLATE STRAND AND ITS CORRESPONDING mRNA AND CODING STRAND SEQUENCES IS FUNDAMENTAL IN MOLECULAR BIOLOGY. WHEN GIVEN A SPECIFIC DNA TEMPLATE (ALSO KNOWN AS THE ANTISENSE STRAND), THE TASK INVOLVES UNDERSTANDING HOW THE GENETIC CODE IS TRANSCRIBED INTO MESSENGER RNA (mRNA), WHICH THEN GUIDES PROTEIN SYNTHESIS. THIS ARTICLE PROVIDES A COMPREHENSIVE, IN-DEPTH EXPLANATION OF THE PROCESS, FOCUSING ON A SPECIFIC EXAMPLE: THE TEMPLATE STRAND 3'-TACCTGCGGGATATT-5'. WE WILL EXPLORE THE PRINCIPLES OF DNA TRANSCRIPTION, THE RULES GOVERNING BASE PAIRING, AND THE STEP-BY-STEP DERIVATION OF THE RESULTANT mRNA AND CODING DNA STRAND SEQUENCES.

FUNDAMENTALS OF DNA STRUCTURE AND TRANSCRIPTION

BEFORE DELVING INTO THE SPECIFICS, IT'S ESSENTIAL TO REVIEW SOME FOUNDATIONAL CONCEPTS:

DNA STRANDS AND THEIR ORIENTATION

- ANTISENSE/TEMPLATE STRAND: THE DNA STRAND USED AS A TEMPLATE DURING TRANSCRIPTION. IT RUNS IN THE 3' TO 5' DIRECTION, PROVIDING THE PATTERN FOR SYNTHESIZING mRNA.
- SENSE/CODING STRAND: THE COMPLEMENTARY DNA STRAND THAT HAS THE SAME SEQUENCE AS THE mRNA (EXCEPT THAT THYMINE (T) IN DNA IS REPLACED WITH URACIL (U) IN RNA). IT RUNS 5' TO 3'.
- mRNA: THE MESSENGER RNA TRANSCRIBED FROM THE TEMPLATE STRAND, WHICH IS COMPLEMENTARY TO THE TEMPLATE AND NEARLY IDENTICAL TO THE CODING STRAND.

DIRECTIONALITY AND BASE PAIRING RULES

- DNA STRANDS ARE ANTIPARALLEL: ONE RUNS 3' TO 5', THE OTHER 5' TO 3'.
- DURING TRANSCRIPTION, RNA POLYMERASE READS THE ANTISENSE (TEMPLATE) STRAND IN THE 3' TO 5' DIRECTION AND SYNTHESIZES THE mRNA IN THE 5' TO 3' DIRECTION.
- BASE PAIRING RULES:
 - ADENINE (A) PAIRS WITH URACIL (U) IN RNA (OR THYMINE (T) IN DNA)
 - THYMINE (T) PAIRS WITH ADENINE (A)
 - CYTOSINE (C) PAIRS WITH GUANINE (G)
 - GUANINE (G) PAIRS WITH CYTOSINE (C)

GIVEN DNA TEMPLATE STRAND: 3'-TACCTGCGGGATATT-5'

THIS SEQUENCE IS PROVIDED WITH A 3' TO 5' ORIENTATION, INDICATING THE DIRECTION IN WHICH THE TEMPLATE STRAND IS READ DURING TRANSCRIPTION.

SEQUENCE BREAKDOWN:

- 3' END: T A C C T G C G G G A T A T T
- 5' END: (COMPLEMENTARY TO THE 3' END)

DETERMINING THE mRNA SEQUENCE

THE PRIMARY GOAL IS TO DERIVE THE mRNA SEQUENCE TRANSCRIBED FROM THE GIVEN ANTISENSE DNA STRAND.

STEP 1: IDENTIFY THE TEMPLATE STRAND ORIENTATION

- THE SEQUENCE IS READ FROM 3' TO 5' (AS GIVEN).
- RNA POLYMERASE SYNTHESIZES THE mRNA IN THE 5' TO 3' DIRECTION, COMPLEMENTARY TO THE DNA TEMPLATE STRAND.

STEP 2: APPLY BASE PAIRING RULES

- FOR EACH NUCLEOTIDE ON THE DNA TEMPLATE STRAND (ANTISENSE), DETERMINE ITS COMPLEMENTARY RNA BASE:
 - T (DNA) PAIRS WITH A (RNA)
 - A (DNA) PAIRS WITH U (RNA)
 - G (DNA) PAIRS WITH C (RNA)
 - C (DNA) PAIRS WITH G (RNA)

STEP 3: TRANSCRIBE THE SEQUENCE

- READ THE DNA TEMPLATE STRAND FROM 3' TO 5' AND WRITE THE COMPLEMENTARY RNA SEQUENCE FROM 5' TO 3'.

STEP-BY-STEP TRANSCRIPTION:

DNA TEMPLATE (3' TO 5')	NUCLEOTIDE	CORRESPONDING mRNA (5' TO 3')
----- ----- -----		-----
T A A		A U U

	C		G		G	
	C		G		G	
	T		A		A	
	G		C		C	
	C		G		G	
	G		C		C	
	G		C		C	
	A		U		U	
	T		A		A	
	T		A		A	

mRNA SEQUENCE (READ FROM 5' TO 3'):

- STARTING FROM THE 5' END, THE SEQUENCE WOULD BE:

5'-AUGGACGCCCUAUAU-3'

NOTE: IT'S MORE STRAIGHTFORWARD TO WRITE THE SEQUENCE IN THE 5' TO 3' DIRECTION AFTER TRANSCRIPTION:

- ORIGINAL DNA TEMPLATE (3' TO 5'): 3'-T A C C T G C G G G A T A T T-5'

- TRANSCRIBED mRNA (5' TO 3'): 5'-A U G G A C G C C C U A U A U-3'

DERIVING THE CODING (SENSE) DNA STRAND

THE CODING STRAND (ALSO CALLED THE SENSE STRAND) RUNS IN THE 5' TO 3' DIRECTION AND HAS A SEQUENCE IDENTICAL TO THE mRNA, EXCEPT THAT IT CONTAINS THYMINE (T) INSTEAD OF URACIL (U).

HOW TO FIND IT:

- IT IS THE COMPLEMENT OF THE TEMPLATE STRAND.
- FOR EACH BASE IN THE TEMPLATE STRAND, FIND ITS COMPLEMENT:

	TEMPLATE (3' TO 5')		SENSE DNA (5' TO 3')	
	-----		-----	
	T		A	
	A		T	
	C		G	
	C		G	
	T		A	
	G		C	
	C		G	
	G		C	
	G		C	
	A		T	
	T		A	
	T		A	

SENSE DNA SEQUENCE:

- 5'-ATGGACGCCCTATAT-3'

THIS SEQUENCE MATCHES THE mRNA SEQUENCE (EXCEPT T FOR U), CONFIRMING THE TRANSCRIPTION PROCESS.

SUMMARY OF SEQUENCES

SEQUENCE TYPE	SEQUENCE (5' TO 3')	NOTES
TEMPLATE (ANTISENSE)	3'-T A C C T G C G G G A T A T T-5'	PROVIDED IN THE QUESTION
mRNA	5'-A U G G A C G C C C U A U A U-3'	TRANSCRIBED FROM THE TEMPLATE STRAND
CODING (SENSE) DNA	5'-A T G G A C G C C C T A T A T-3'	COMPLEMENTARY TO THE TEMPLATE; SAME AS mRNA (U REPLACED WITH T)

DEEP DIVE INTO TRANSCRIPTION MECHANICS

UNDERSTANDING THE PROCESS IN DETAIL ENHANCES COMPREHENSION:

INITIATION

- TRANSCRIPTION BEGINS WHEN RNA POLYMERASE BINDS TO SPECIFIC PROMOTER REGIONS ON THE DNA.
- THE ENZYME UNWINDS A SMALL SECTION OF THE DNA DOUBLE HELIX, EXPOSING THE ANTISENSE (TEMPLATE) STRAND.

ELONGATION

- RNA POLYMERASE MOVES ALONG THE DNA TEMPLATE STRAND IN THE 3' TO 5' DIRECTION.
- IT SYNTHESIZES THE COMPLEMENTARY mRNA STRAND IN THE 5' TO 3' DIRECTION.
- THE BASE PAIRING RULES ENSURE THAT FOR EACH DNA NUCLEOTIDE, THE CORRECT COMPLEMENTARY RNA NUCLEOTIDE IS INCORPORATED.

TERMINATION

- ONCE THE POLYMERASE SYNTHESIZES A COMPLETE TRANSCRIPT, IT DETACHES FROM THE DNA, RELEASING THE mRNA.
-

IMPLICATIONS AND APPLICATIONS

UNDERSTANDING THE EXACT SEQUENCE DERIVED FROM A GIVEN DNA TEMPLATE HAS MULTIPLE APPLICATIONS:

- GENE EXPRESSION ANALYSIS: KNOWING THE TRANSCRIBED mRNA HELPS IN STUDYING GENE EXPRESSION REGULATION.
 - PROTEIN SYNTHESIS: THE mRNA SEQUENCE DETERMINES THE AMINO ACID SEQUENCE OF THE RESULTING PROTEIN VIA THE GENETIC CODE.
 - GENETIC MUTATIONS: ALTERATIONS IN THE DNA TEMPLATE SEQUENCE CAN LEAD TO CHANGES IN THE mRNA AND, CONSEQUENTLY, THE PROTEIN, IMPACTING ORGANISM HEALTH.
 - BIOTECHNOLOGY: SYNTHETIC BIOLOGY AND GENETIC ENGINEERING OFTEN RELY ON PRECISE DNA TO mRNA TO PROTEIN TRANSLATION PATHWAYS.
-

ADDITIONAL CONSIDERATIONS

WHILE THE PROCESS DESCRIBED IS STRAIGHTFORWARD FOR THIS EXAMPLE, REAL-WORLD SCENARIOS MAY INVOLVE COMPLEXITIES SUCH AS:

- ALTERNATIVE SPLICING: DIFFERENT COMBINATIONS OF EXONS CAN LEAD TO MULTIPLE PROTEINS FROM A SINGLE GENE.
- POST-TRANSCRIPTIONAL MODIFICATIONS: MODIFICATIONS LIKE 5' CAPPING, POLYADENYLATION, AND SPLICING AFFECT mRNA STABILITY AND TRANSLATION EFFICIENCY.
- MUTATIONS: SUBSTITUTIONS, INSERTIONS, OR DELETIONS IN THE DNA CAN ALTER THE TRANSCRIBED mRNA SEQUENCE AND THE RESULTING PROTEIN.

CONCLUSION

IN CONCLUSION, STARTING WITH THE GIVEN DNA TEMPLATE STRAND 3'-TACCTGCGGGATATT-5', THE TRANSCRIBED mRNA SEQUENCE IS 5'-AUGGACGCCCUAUAU-3'. THIS PROCESS EXEMPLIFIES THE FUNDAMENTAL PRINCIPLES OF MOLECULAR BIOLOGY, ILLUSTRATING HOW GENETIC INFORMATION FLOWS FROM DNA TO RNA, ULTIMATELY GUIDING PROTEIN SYNTHESIS. BY UNDERSTANDING THE BASE PAIRING RULES AND TRANSCRIPTION MECHANICS,

[Given The Sequence Of 3 Tacctgcgggatatt 5 On The Template Antisense Dna Strand What Will Be The Sequence](#)

Given The Sequence Of 3 Tacctgcgggatatt 5 On The Template Antisense Dna Strand What Will Be The Sequence

Related Articles

- [How Did Political Symbols Such As Propaganda Posters Affect The Home Front In World War I? a. They Convinced](#)
- [In What Way Did The Watergate Scandal Lead To Partisan Politics? a. Republicans Blamed Democrats For Illegal](#)
- [The Output Of U.S. Citizens Who Work In Canada Would Be Included In The O Gross Domestic Product Of Canada.](#)

[Back to Home](#)