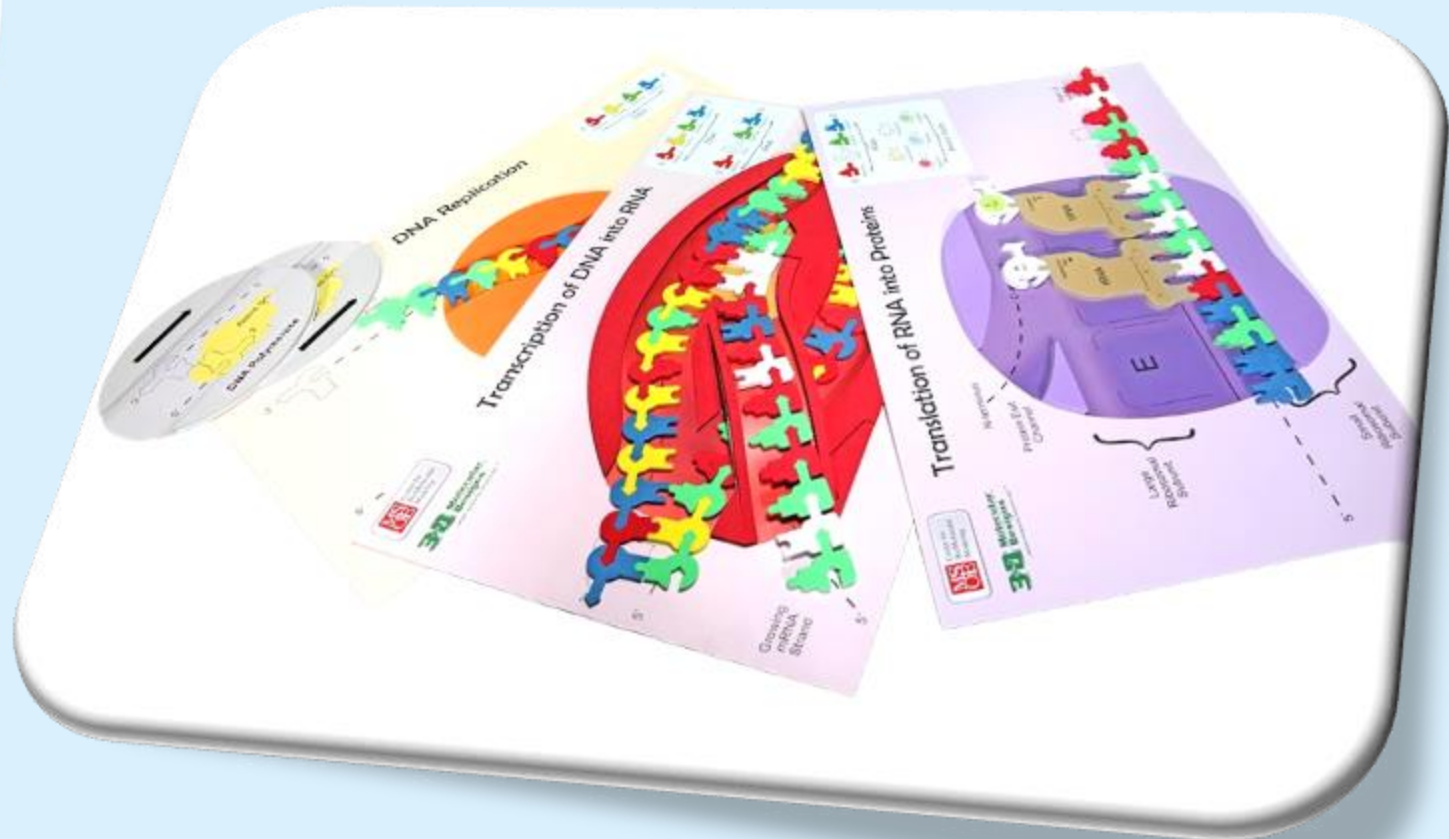
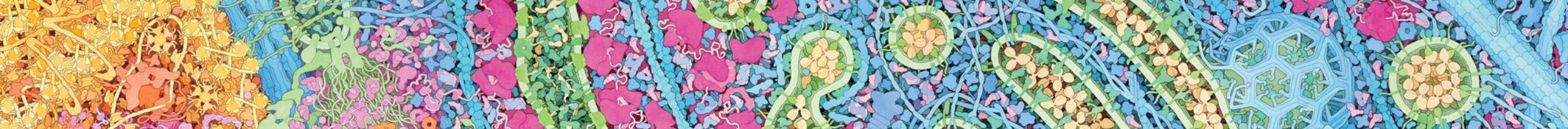


Unwinding the Complexities of the Central Dogma





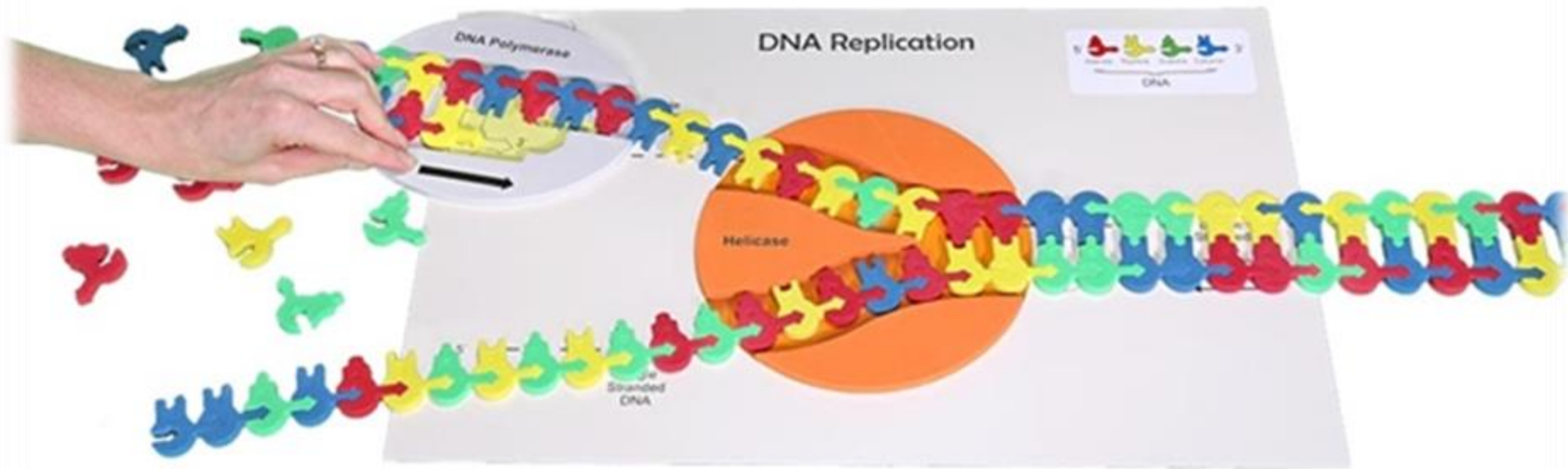
Ruth Hutson, MSSE



Workshop Learning Goals

- Explain the purpose and process of transcription and translation using models of DNA and RNA.
- Explore how physical models foster an understanding of how the structure of DNA and RNA determine the structure of proteins, which carry out the essential functions of life.
- Have fun!

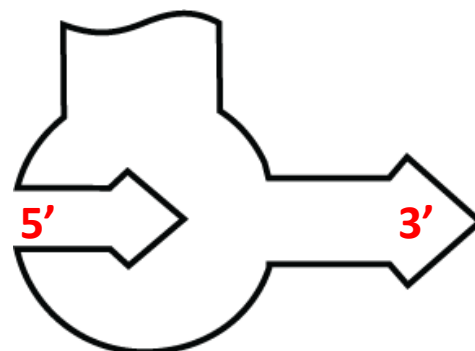
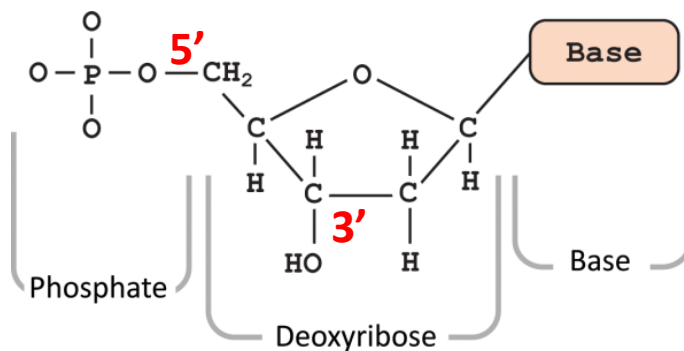
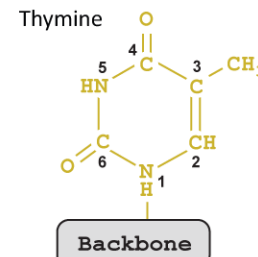
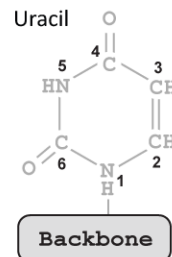
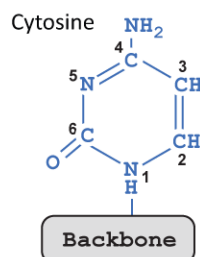
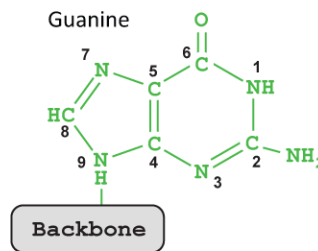
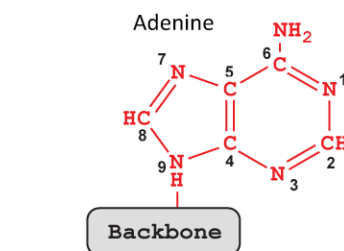
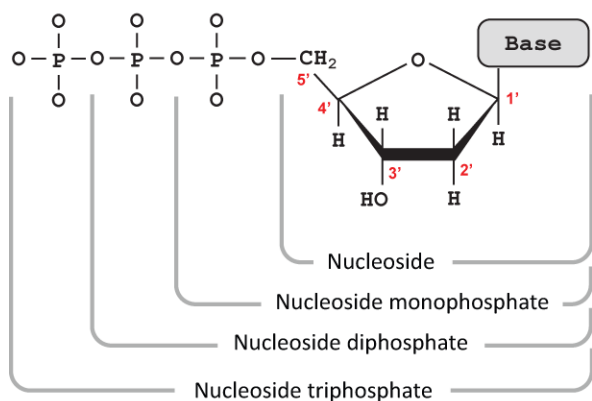
Replication



Replication



Transcription

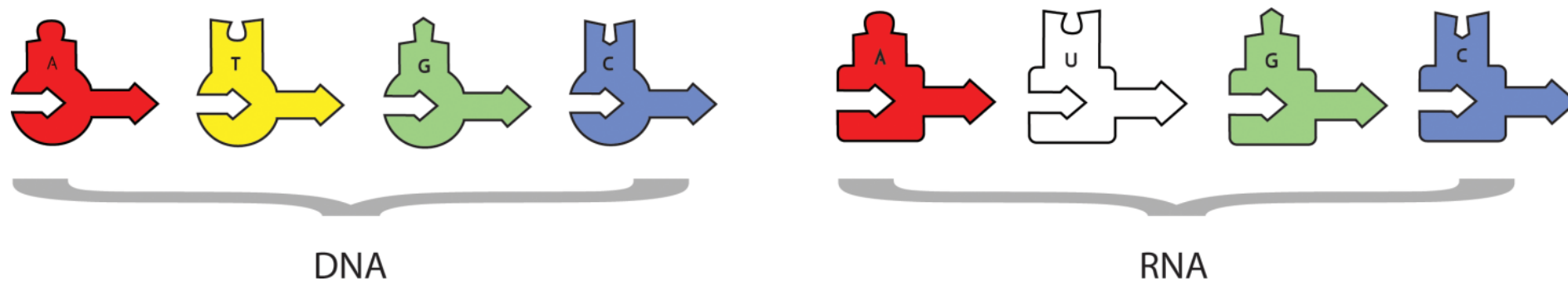


Helpful Hints:

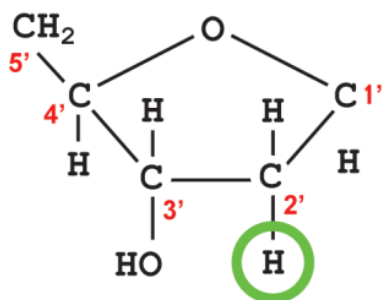
Take care in loading the DNA in the RNA polymerase.

Remember RNA is synthesized from the 5' to the 3' end.

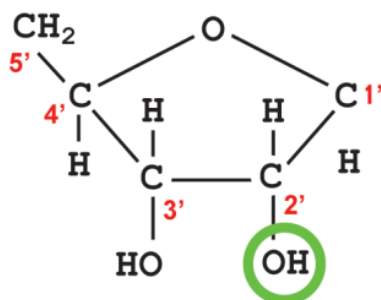
Transcription



Deoxyribose
found in DNA



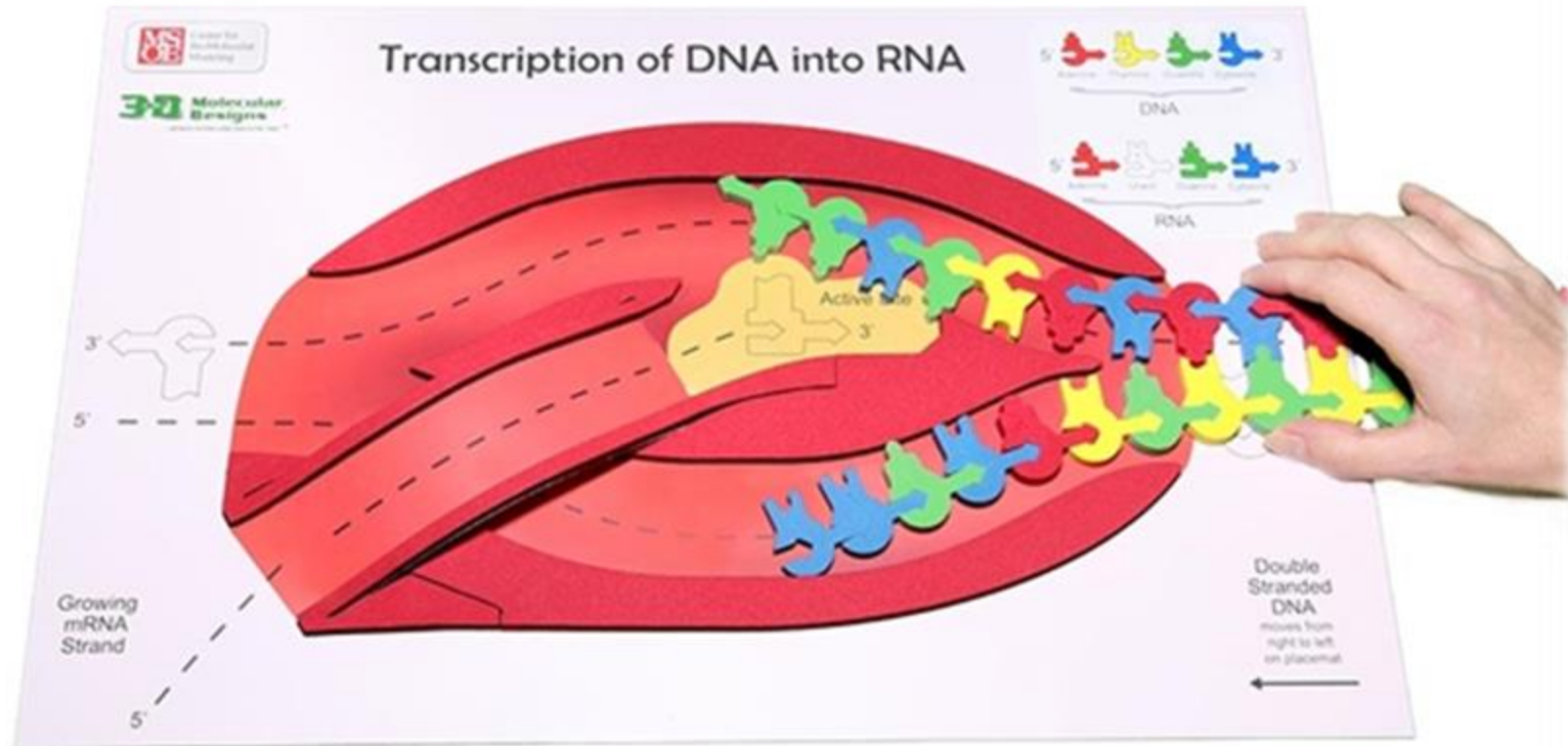
Ribose
found in RNA



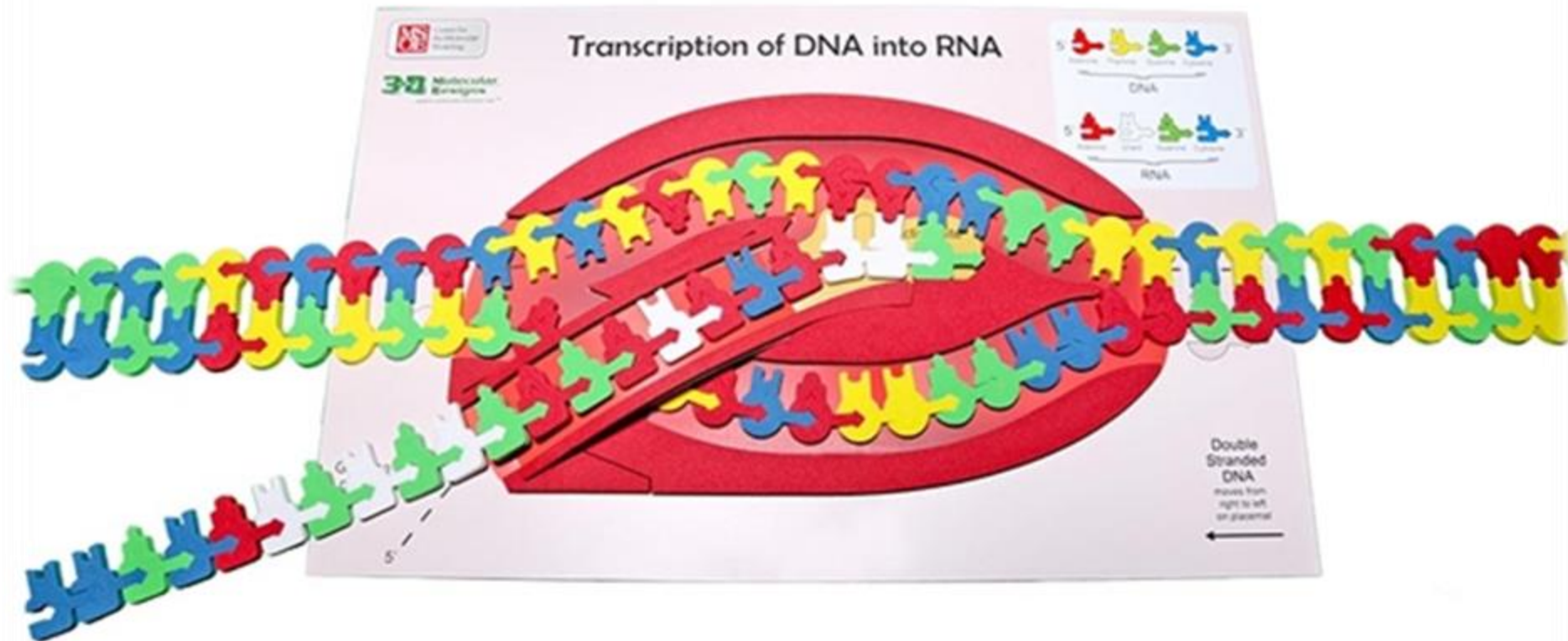
Helpful Hint:

The DNA pieces are different than the RNA pieces!

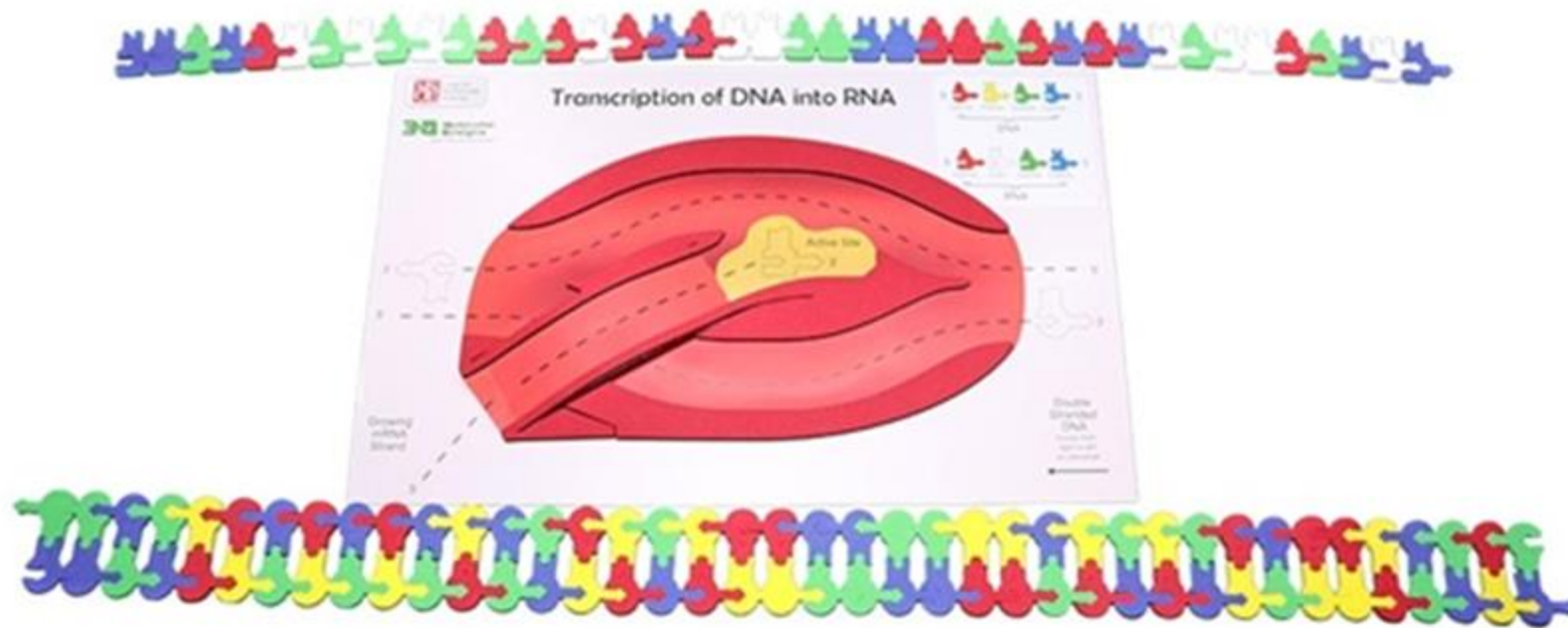
Transcription: Initiation



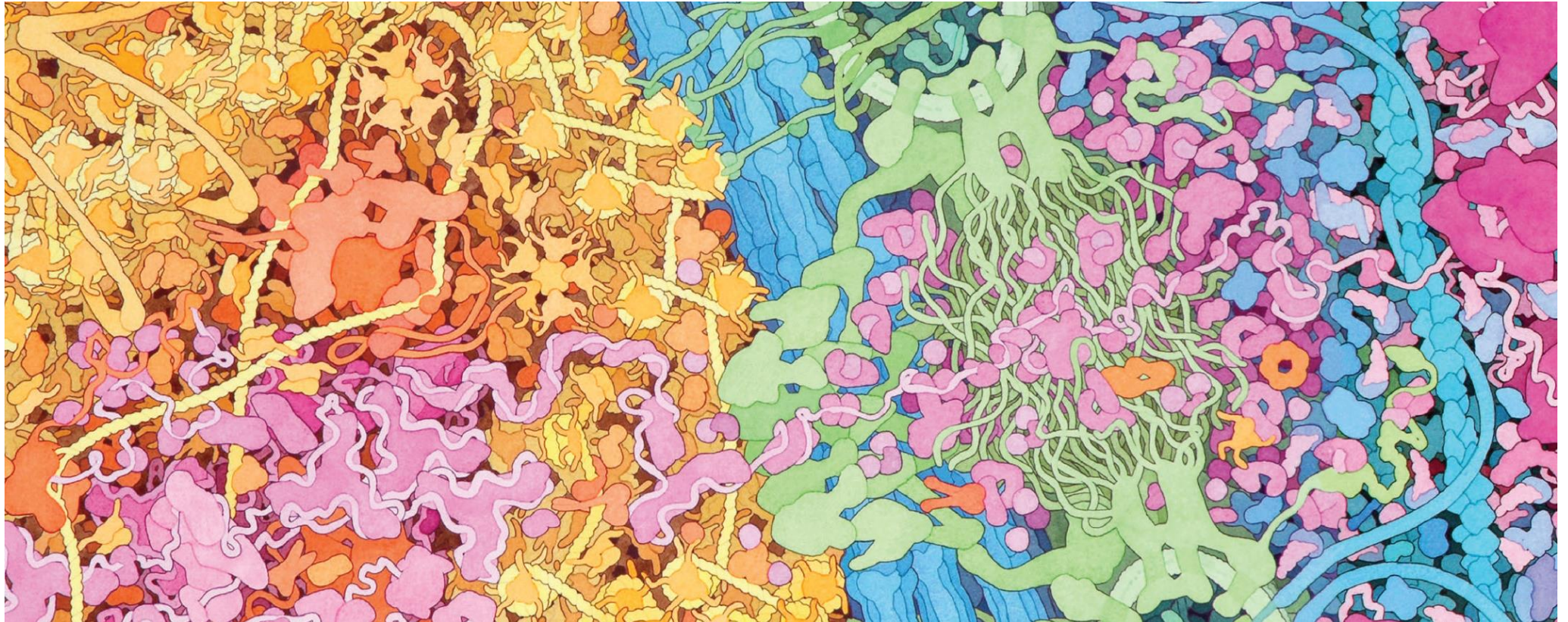
Transcription: Elongation



Transcription: Termination



A brief tour through the cell

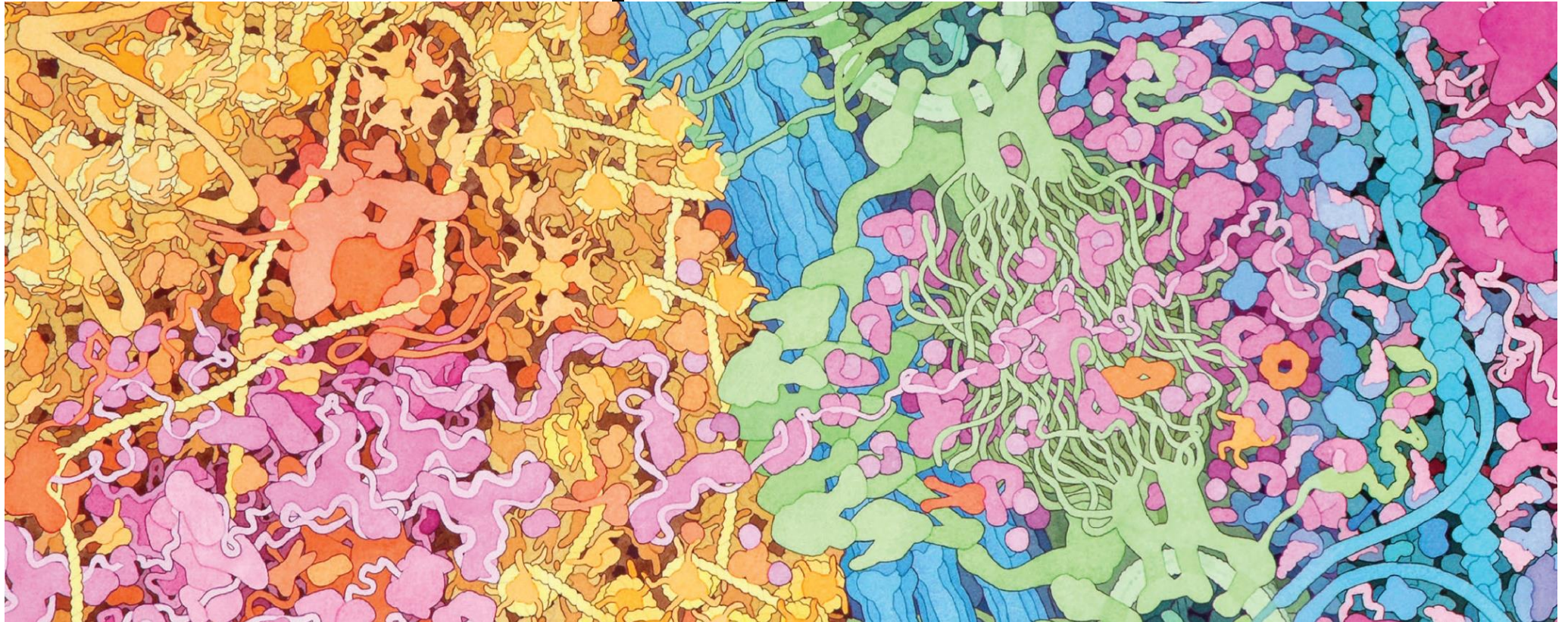


This image is an excerpt from Tour of a Human Cell by David Goodsell, as shown in 3D Molecular Designs' Tour of a Human Cell© poster and David Goodsell's book, *The Machinery of Life*.

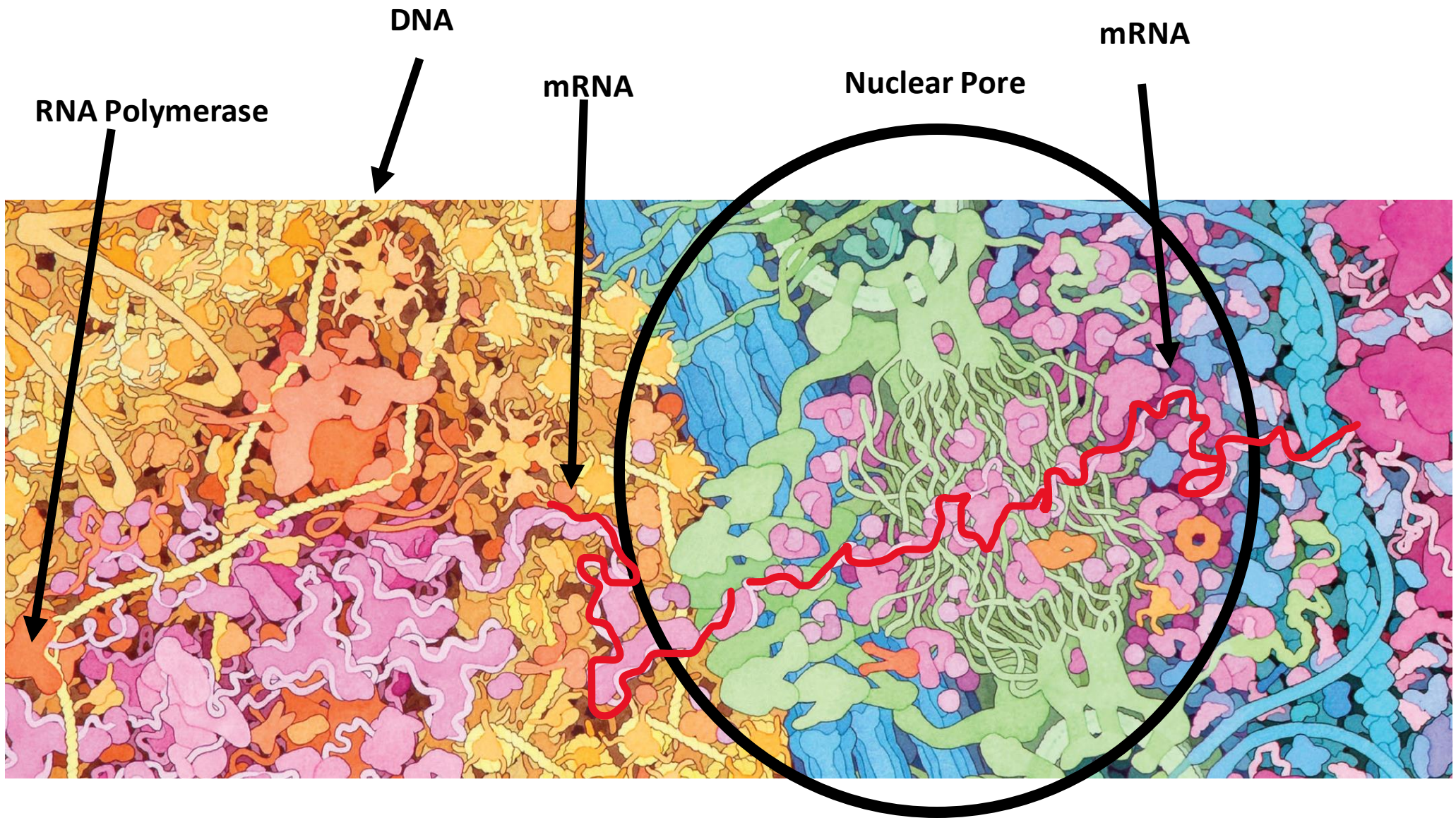
Nucleus

Nuclear
Membrane

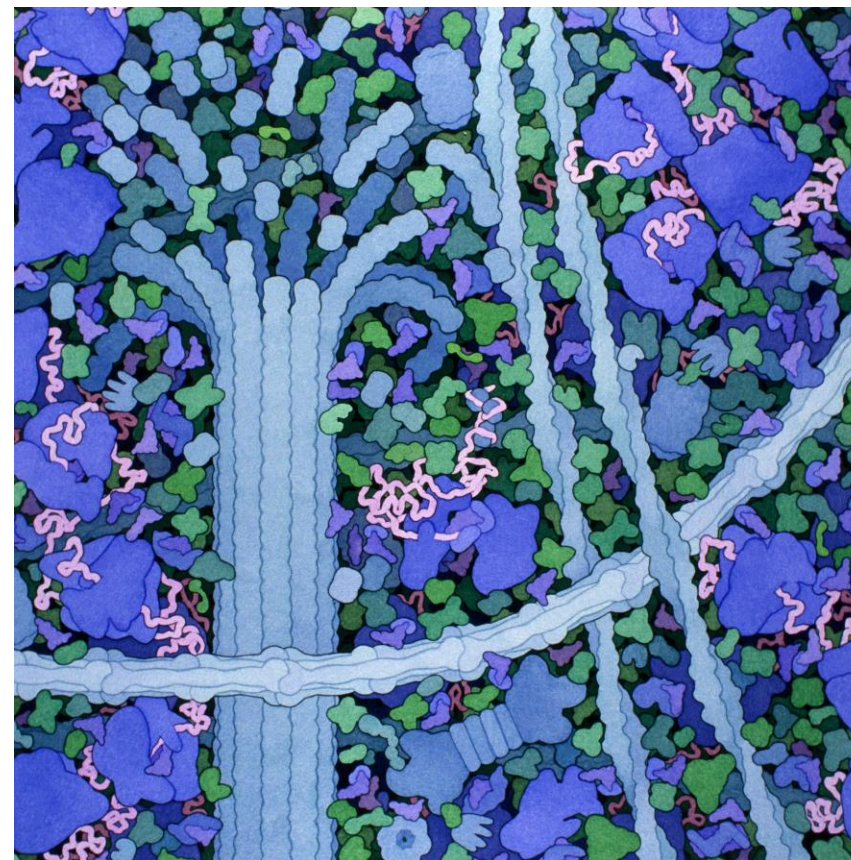
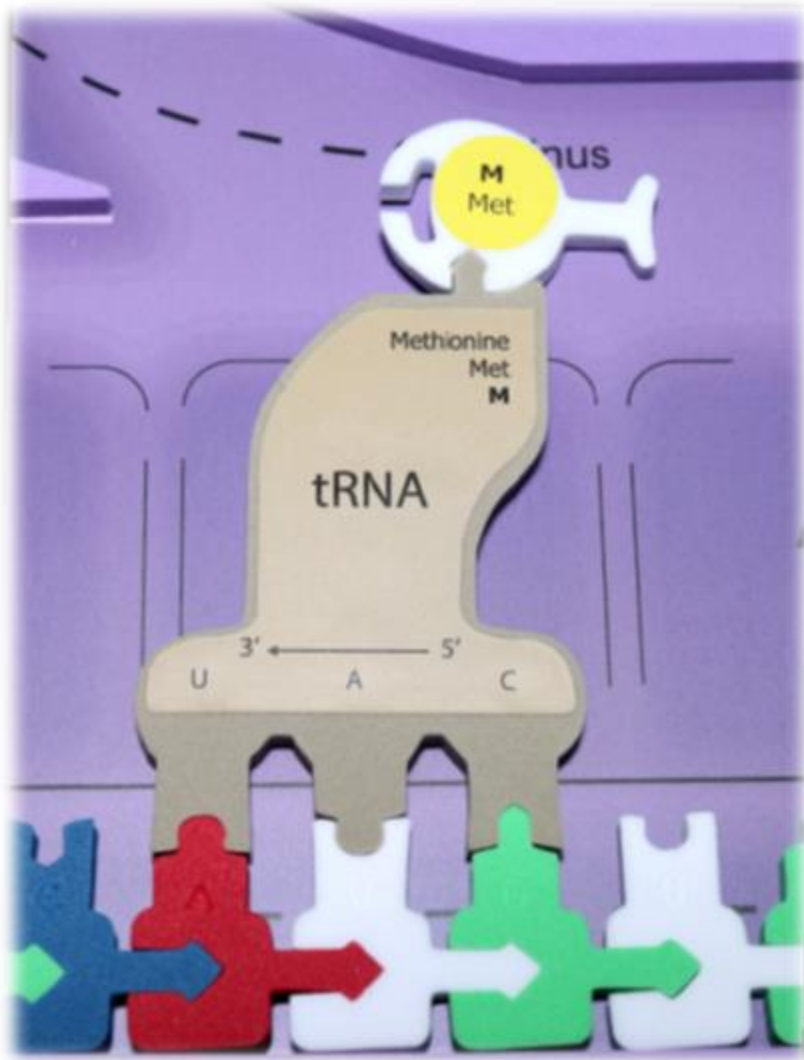
Cytoplasm



This image is an excerpt from Tour of a Human Cell by David Goodsell, as shown in 3D Molecular Designs' Tour of a Human Cell© poster and David Goodsell's book, *The Machinery of Life*.



Translation



Acknowledgement: Illustration by David S. Goodsell. doi: 10.2210/rcsb_pdb/goodsell-gallery-006

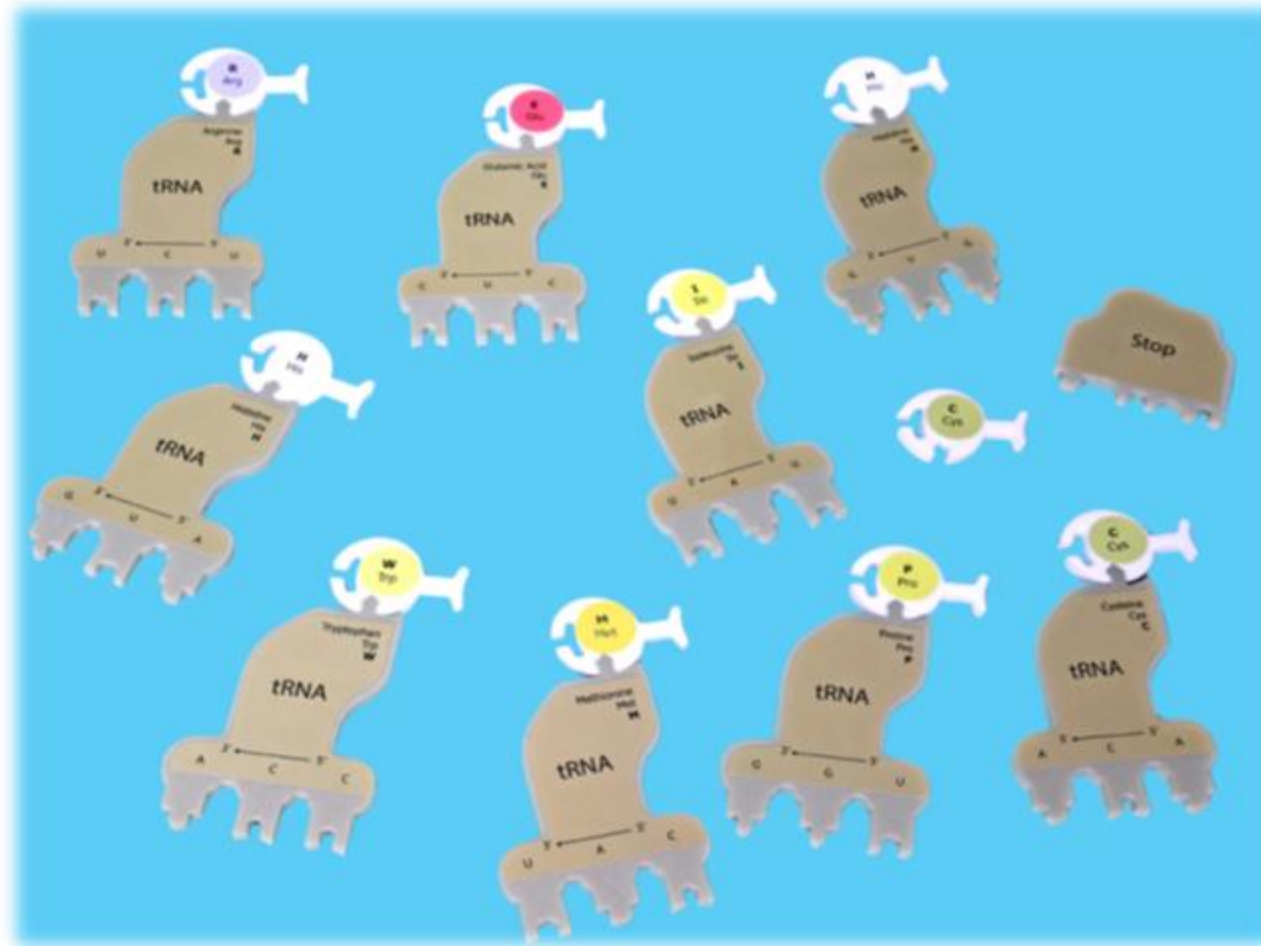
The Genetic Codon Chart®

	U	C	A	G	
U	UUU → Phe F UUC → Phe F UUA → Leu L UUG → Leu L	UCU → Ser S UCC → Ser S UCA → Ser S UCG → Ser S	UAU → Tyr Y UAC → Tyr Y UAA → Stop UAG → Stop	UGU → Cys C UGC → Cys C UGA → Stop UGG → Trp W	U C A G
C	CUU → Leu L CUC → Leu L CUA → Leu L CUG → Leu L	CCU → Pro P CCC → Pro P CCA → Pro P CCG → Pro P	CAU → His H CAC → His H CAA → Gln Q CAG → Gln Q	CGU → Arg R CGC → Arg R CGA → Arg R CGG → Arg R	U C A G
A	AUU → Ile I AUC → Ile I AUA → Ile I AUG → Met M	ACU → Thr T ACC → Thr T ACA → Thr T ACG → Thr T	AAU → Asn N AAC → Asn N AAA → Lys K AAG → Lys K	AGU → Ser S AGC → Ser S AGA → Arg R AGG → Arg R	U C A G
G	GUU → Val V GUC → Val V GUA → Val V GUG → Val V	GCU → Ala A GCC → Ala A GCA → Ala A GCG → Ala A	GAU → Asp D GAC → Asp D GAA → Glu E GAG → Glu E	GGU → Gly G GGC → Gly G GGA → Gly G GGG → Gly G	U C A G

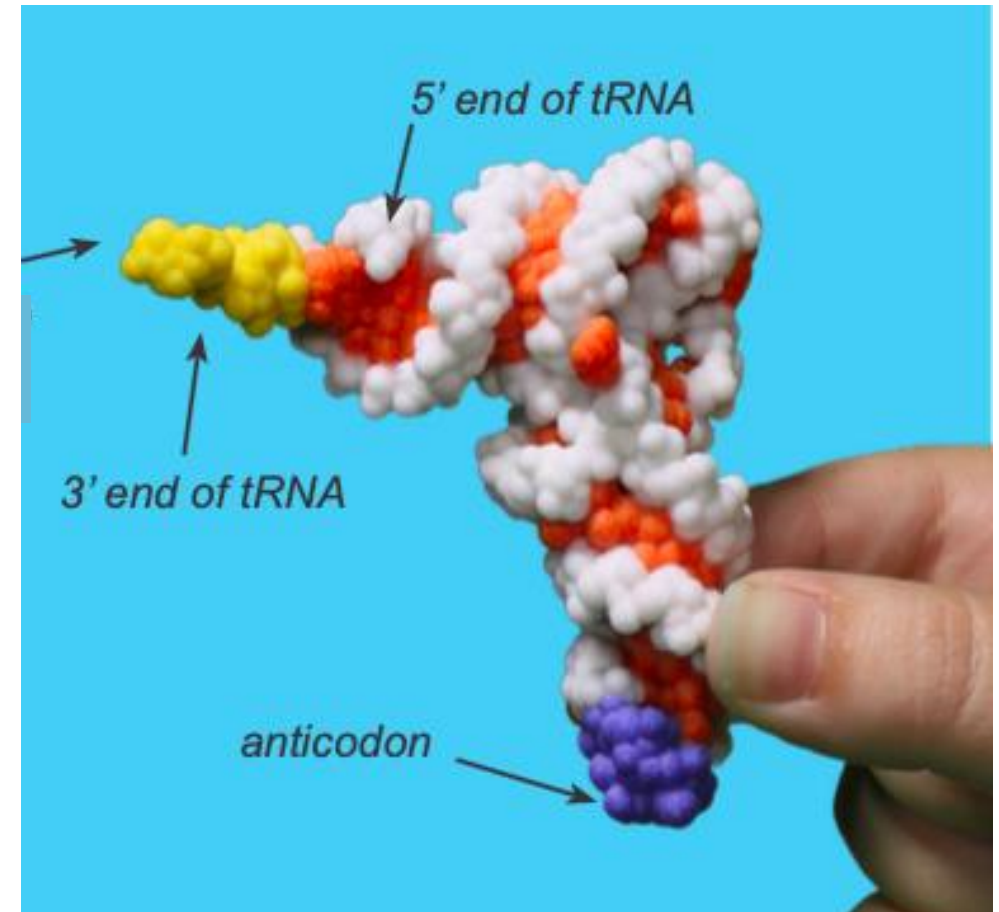
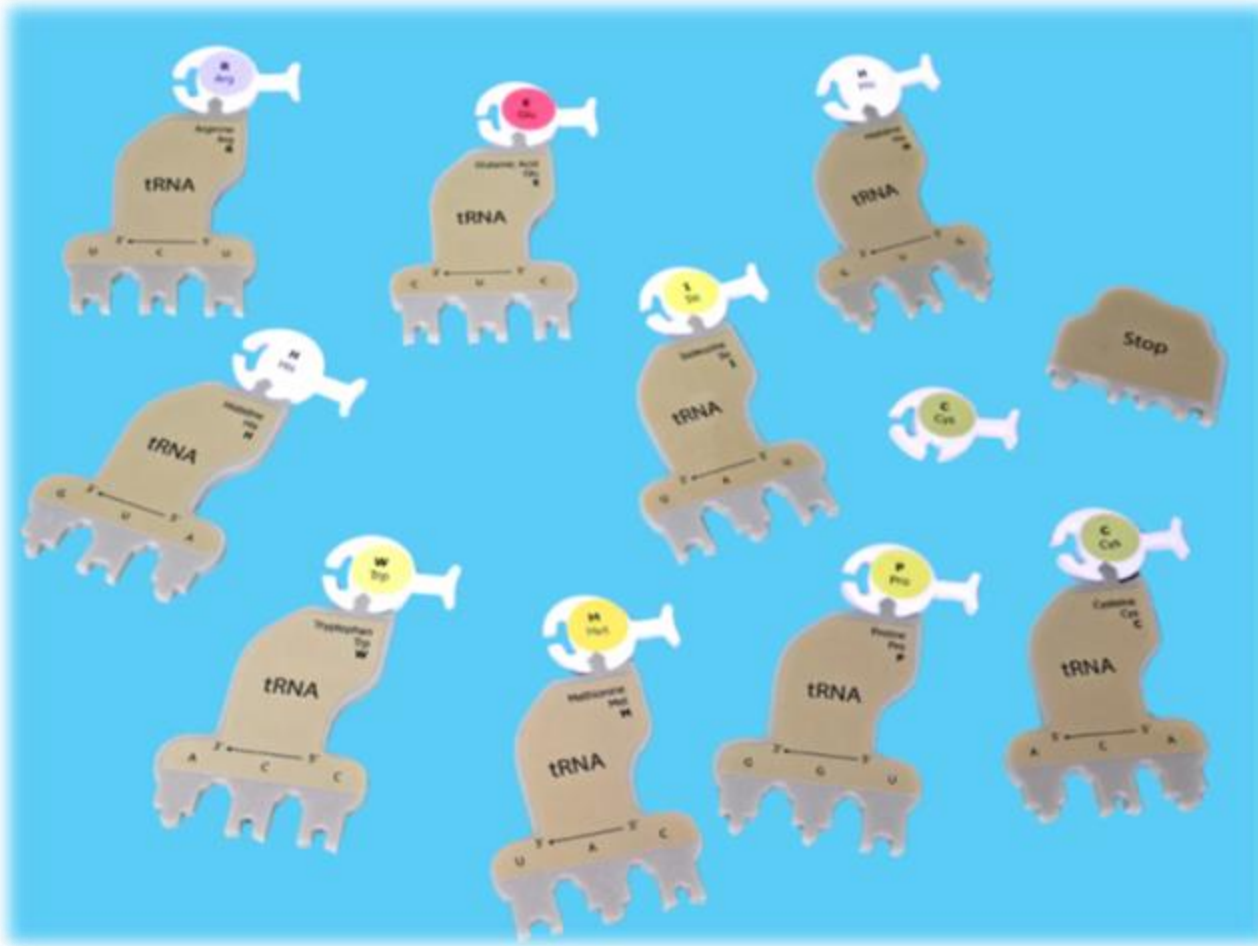
Amino Acid Properties

 Translation Start Codon	 Hydrophobic / Non-polar	 Negative Charge	 Cysteine
 Translation Stop Codon	 Hydrophilic / Polar	 Positive Charge	

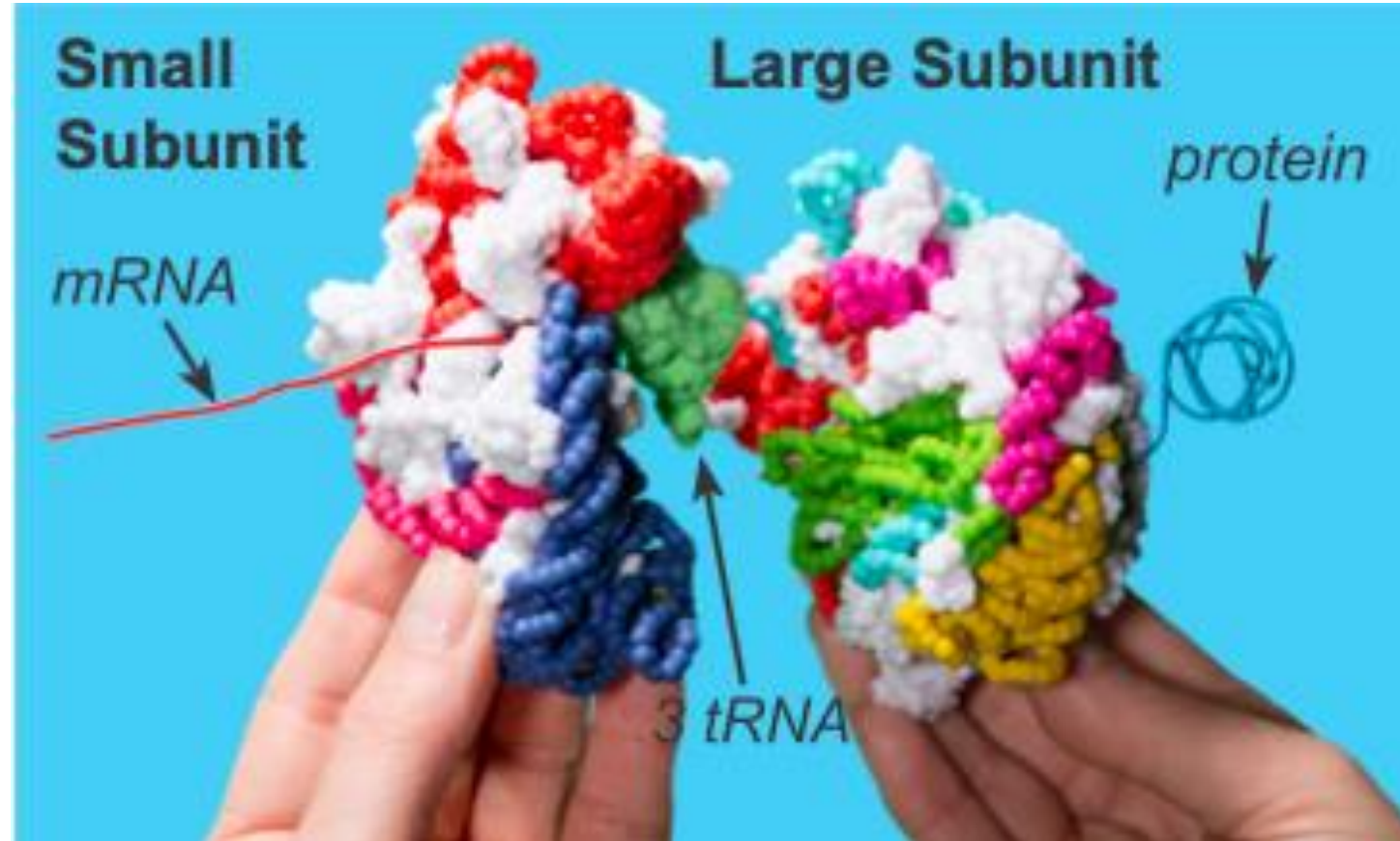
Pair the tRNA with the amino acids



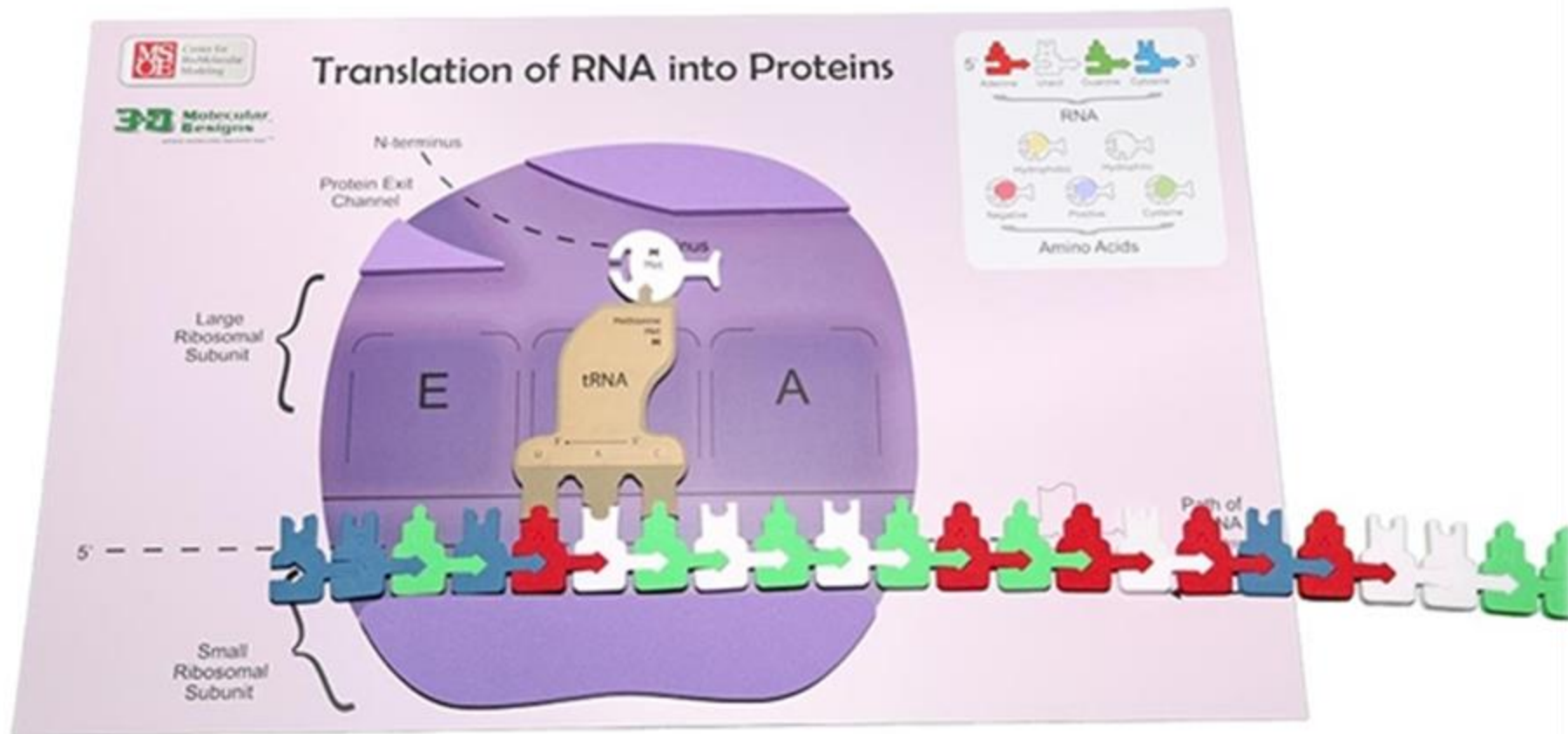
A closer look at tRNAs



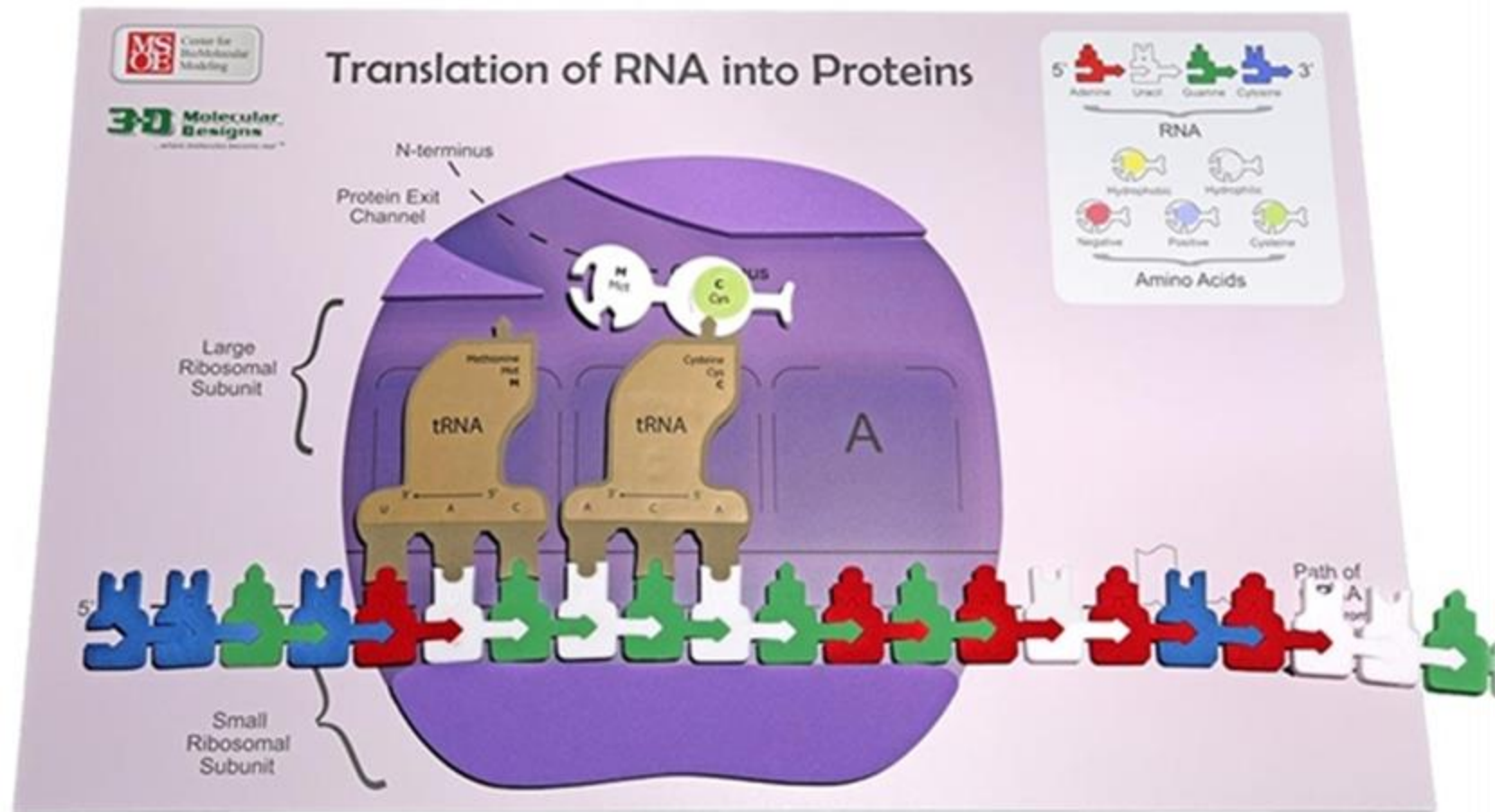
A closer look at ribosomes



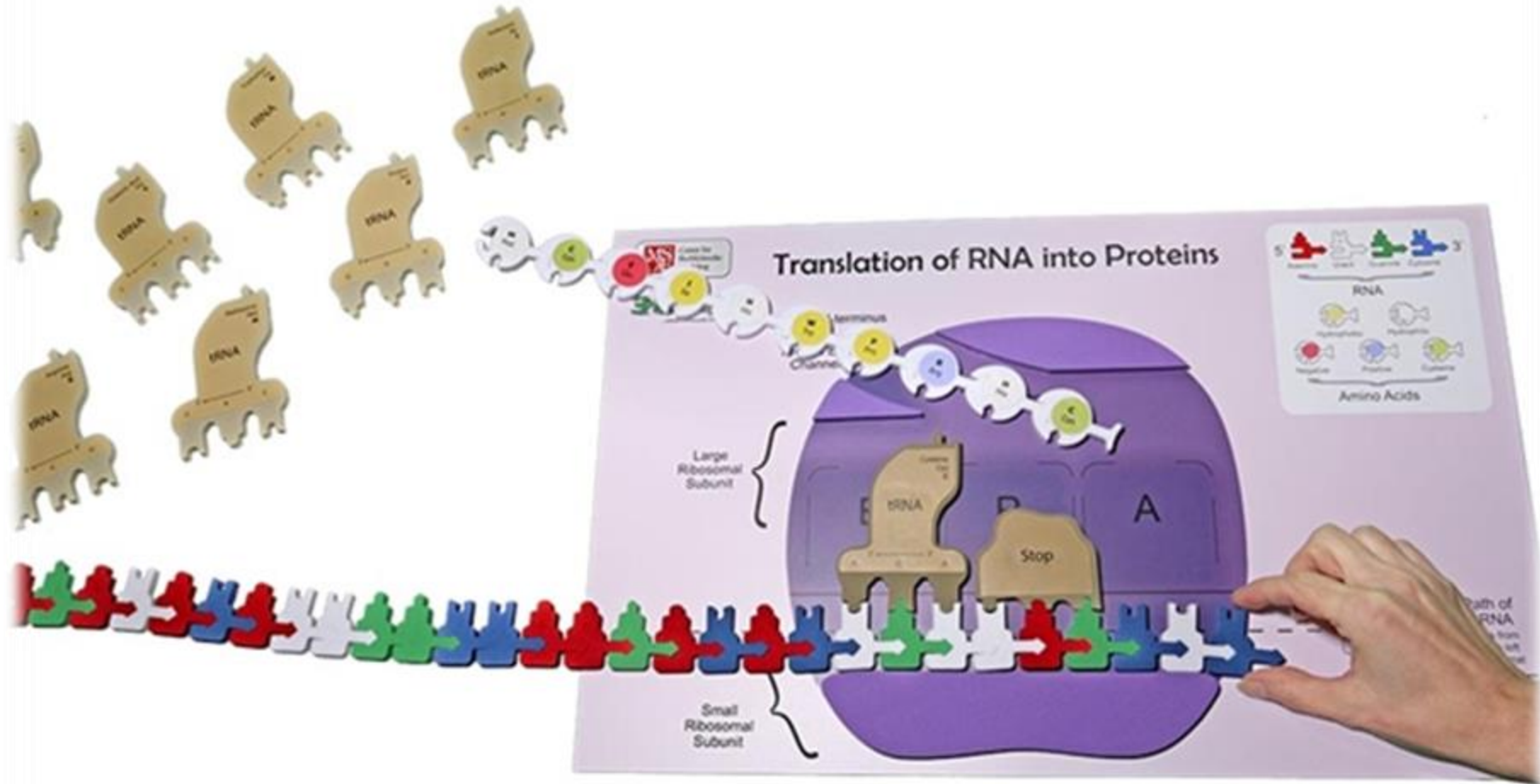
Translation: Initiation



Translation: Elongation



Translation: Termination



The Genetic Codon Chart®

	U	C	A	G	
U	UUU → Phe F UUC → Phe F UUA → Leu L UUG → Leu L	UCU → Ser S UCC → Ser S UCA → Ser S UCG → Ser S	UAU → Tyr Y UAC → Tyr Y UAA → Stop UAG → Stop	UGU → Cys C UGC → Cys C UGA → Stop UGG → Trp W	U C A G
C	CUU → Leu L CUC → Leu L CUA → Leu L CUG → Leu L	CCU → Pro P CCC → Pro P CCA → Pro P CCG → Pro P	CAU → His H CAC → His H CAA → Gln Q CAG → Gln Q	CGU → Arg R CGC → Arg R CGA → Arg R CGG → Arg R	U C A G
A	AUU → Ile I AUC → Ile I AUA → Ile I AUG → Met M	ACU → Thr T ACC → Thr T ACA → Thr T ACG → Thr T	AAU → Asn N AAC → Asn N AAA → Lys K AAG → Lys K	AGU → Ser S AGC → Ser S AGA → Arg R AGG → Arg R	U C A G
G	GUU → Val V GUC → Val V GUA → Val V GUG → Val V	GCU → Ala A GCC → Ala A GCA → Ala A GCG → Ala A	GAU → Asp D GAC → Asp D GAA → Glu E GAG → Glu E	GGU → Gly G GGC → Gly G GGA → Gly G GGG → Gly G	U C A G

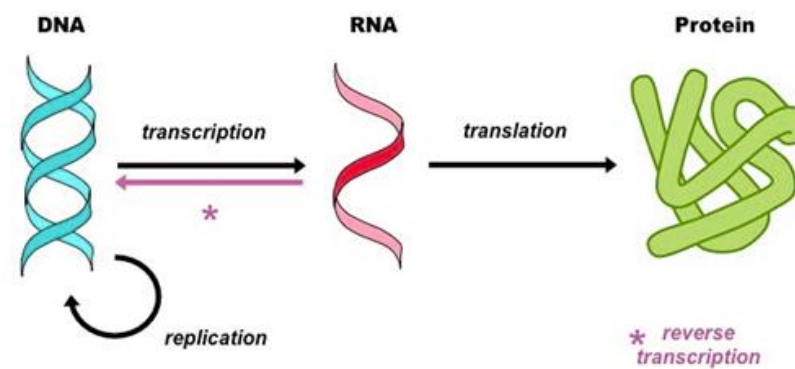
Amino Acid Properties

 Translation Start Codon	 Hydrophobic / Non-polar	 Negative Charge	 Cysteine
 Translation Stop Codon	 Hydrophilic / Polar	 Positive Charge	

Let's review

DNA Base	RNA Base
T	A
G	C
C	G
A	U
C	G
A	U

CENTRAL DOGMA



DNA and RNA



Workshop NGSS Connections

(and/or other applicable standards)

SEPs	CCCs	DCIs	TEKS
Using Mathematics and Computational Thinking	Scale, Proportion, and Quantity	5-PS1-2	Student Expectation- B.6C
Developing and Using Models	Patterns	MS-PS1-1	
Planning and Carrying Out Investigations		HS-PS1-3	

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think.

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