

# DNA project.

Artilect

June 13, 2016

# bases & acides aminés

✚ 4 bases codant l'ADN:

A T G C

# bases & acides aminés

- ❖ 4 bases codant l'ADN:

A T G C

- ❖ 3 bases (codon) → 1 acide aminé

# bases & acides aminés

- 4 bases codant l'ADN:

A T G C

- 3 bases (codon) → 1 acide aminé

- 20 acides aminés codant les protéines:

A C D E F G H I K L M  
N P Q R S T V W Y

# bases & acides aminés

- ❖ 4 bases codant l'ADN:

A T G C

- ❖ 3 bases (codon) → 1 acide aminé

- ❖ 20 acides aminés codant les protéines:

A C D E F G H I K L M  
N P Q R S T V W Y

- ❖ première combinaison de bases ATG → M:  
Signal START

# bases & acides aminés

- ❖ 4 bases codant l'ADN:

A T G C

- ❖ 3 bases (codon) → 1 acide aminé

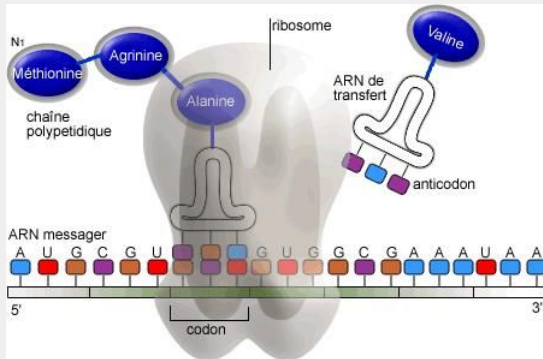
- ❖ 20 acides aminés codant les protéines:

A C D E F G H I K L M  
N P Q R S T V W Y

- ❖ première combinaison de bases ATG → M:  
Signal START

- ❖ 3 combinaisons de bases:  
Signal STOP

# Mécanisme



# Sequences

>Homo sapiens hemoglobin, **DNA**

```
CATAAACCTGGCGCGCTCGCGGCCCGGCACTCTTCTGGTCCCCACAGACTCAGAGAGAACCCACCATGG
TGCTGTCTCCTGCCGACAAGACCAACGTCAAGGCCGCTGGGGTAAGGTCGGCGCGCACGCTGGCGAGTA
TGGTGCGGAGGCCCTGGAGAGGATGTTCTGTCTTCCCCACCACCAAGACCTACTTCCCGCACTTCGAC
CTGAGCCACGGCTCTGCCCAGGTTAAGGGCCACGGCAAGAAGGTGGCCGACGCGCTGACCAACGCCGTGG
CGCACGTGGACGACATGCCCAACGCGCTGTCCGCCCTGAGCGACCTGCACGCGCACAAAGCTTCGGGTGGA
CCCGGTCAACTTCAAGCTCCTAAGCCACTGCCTGCTGGTGACCCTGGCCGCCACCTCCCCGCCGAGTTC
ACCCCTGCGGTGCAACGCTCCCTGGACAAGTTCCTGGCTTCTGTGAGCACCGTGCTGACCTCCAAATACC
GTTAAGCTGGAGCCTCGGTGGCCATGCTTCTTGCCCCTTGGGCCTCCCCCAGCCCCTCCTCCCCTTCCT
GCACCCGTACCCCGTGGTCTTTGAATAAAGTCTGAGTGGCGGCCAAAAAAAAAAAAAAAAAAAAAAAAA
```

>Homo sapiens hemoglobin, **amino acids**

```
MVLSPADKTNVKAAWGKVGGAHAGEYGAEALERMFSLFPTTKTYFPHFDLSHGSAQVKGHGKKVADLTNA
VAHVDDMPNALSALSDLHAHKLRVDPVNFKLLSHCLLVTLAAHLPAEFTPAVHASLDKFLASVSTVLTSKYR
```



# Sequences

>Homo sapiens hemoglobin, **DNA**

```
CATAAACCTGGCGCGCTCGCGGCCCGGCACTCTTCTGGTCCCCACAGACTCAGAGAGAACCCACCATGG
TGCTGTCTCCTGCCGACAAGACCAACGTCAAGGCCGCTGGGGTAAGGTCGGCGCGCACGCTGGCGAGTA
TGGTGCGGAGGCCCTGGAGAGGATGTTCTGTCTTCCCCACCACCAAGACCTACTTCCGCACTTCGAC
CTGAGCCACGGCTCTGCCCAGGTTAAGGGCCACGGCAAGAAGGTGGCCGACGCGCTGACCAACGCCGTGG
CGCACGTGGACGACATGCCAACGCGCTGTCCGCCCTGAGCGACCTGCACGCGCACAAAGCTTCGGGTGGA
CCCGGTCAACTTCAAGCTCCTAAGCCACTGCCTGCTGGTGACCCTGGCCGCCACCTCCCCGCCGAGTTC
ACCCCTGCGGTGCAACGCTCCCTGGACAAGTTCCTGGCTTCTGTGAGCACCGTGCTGACCTCCAAATACC
GTAAAGCTGGAGCCTCGGTGGCCATGCTTCTTGCCCCTTGGGCCTCCCCCAGCCCCTCCTCCCCTTCCT
GCACCCGTACCCCGTGCTTTGAATAAAGTCTGAGTGGCGGCCAAAAAAAAAAAAAAAAAAAAAAAAA
```

>Homo sapiens hemoglobin, **amino acids**

```
MVLSPADKTNVKAAWGKVGGAHAGEYGAEALERMFSLFPTTKTYFPHFDLSHGSQVKGHGKKVADALNTA
VAHVDDMPNALSALSDLHAHKLRVDPVNFKLLSHCLLVTLAAHLPAEFTPAVHASLDKFLASVSTVLTSKYR
```

# Genetic code

1st base	2nd base						3rd base		
	U		C		A		G		
U	UUU	Phenylalanine (F)	UCU	Serine (S)	UAU	Tyrosine (Y)	UGU	Cysteine (C )	U
	UUC		UCC		UAC		UGC		C
	UUA		UCA		UAA	stop codon	UGA	stop codon	A
	UUG		UCG		UAG		UGG		Tryptophan (W)
C	CUU	Leucine (L)	CCU	Proline (P)	CAU	Histidine (H)	CGU	Arginine (R )	U
	CUC		CCC		CAC		CGC		C
	CUA		CCA		CAA		CGA		A
	CUG		CCG		CAG		CGG		G
A	AUU	Isoleucine (I)	ACU	Threonine (T)	AAU	Asparagine (N)	AGU	Serine (S)	U
	AUC		ACC		AAC		AGC		C
	AUA	Methionine (M) & start codon	ACA		AAA	Lysine (K)	AGA	Arginine (R )	A
	AUG		ACG		AAG		AGG		G
G	GUU	Valine (V)	GCU	Alanine (A)	GAU	Aspartic Acid (D)	GGU	Glycine (G)	U
	GUC		GCC		GAC		GGC		C
	GUA		GCA		GAA	GGG	GGA		A
	GUG		GCG		GAG		GGG		G

...	acc	ATG	GTG	CTG	TCT	...	TAA	ttc
...								

# Genetic code

1st base	2nd base						3rd base
	U		C	A		G	
U	UUU	Phenylalanine (F)	UCU	UAU	Tyrosine (Y)	UGU	U
	UUC		UCC			UGC	C
	UUA		UCA	UAA	stop codon	UGA	A
	UUG		UCG	UAG		UGG	G
C	CUU	Leucine (L)	CCU	CAU	Histidine (H)	CGU	U
	CUC		CCC	CAC		CGC	C
	CUA		CCA	CAA	Glutamine (Q)	CGA	A
	CUG		CCG	CAG		CGG	G
A	AUU		ACU	AAU	Asparagine (N)	AGU	U
	AUC		ACC	AAC		AGC	C
	AUA	Methionine (M) & start codon	ACA	AAA	Lysine (K)	AGA	A
	AUG		ACG	AAG		AGG	G
G	GUU		GCU	GAU	Aspartic Acid (D)	GGU	U
	GUC		GCC	GAC		GGC	C
	GUA	Valine (V)	GCA	GAA	Glutamic Acid (E)	GGA	A
	GUG		GCG	GAG		GGG	G

...	acc	ATG	GTG	CTG	TCT	...	TAA	ttc
...	●							

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1st base	2nd base						3rd base			
	U		C		A		G			
U	UUU	Phenylalanine (F)	UCU	Serine (S)	UAU	Tyrosine (Y)	UGU	Cysteine ( C )	U	
	UUC		UCC		UAC		UGC		C	
	UUA		UCA		UAA		UGA		stop codon	A
	UUG		UCG		UAG		UGG		Tryptophan (W)	G
C	CUU	Leucine (L)	CCU	Proline (P)	CAU	Histidine (H)	CGU	Arginine ( R )	U	
	CUC		CCC		CAC		CGC		C	
	CUA		CCA		CAA		CGA		A	
	CUG		CCG		CAG		CGG		G	
A	AUU	Isoleucine (I)	ACU	Threonine (T)	AAU	Asparagine (N)	AGU	Serine (S)	U	
	AUC		ACC		AAC		AGC		C	
	AUA		ACA		AAA		AGA		Arginine ( R )	A
	AUG		Methionine (M) & start codon		ACG		AAG		AGG	G
G	GUU	Valine (V)	GCU	Alanine (A)	GAU	Aspartic Acid (D)	GGU	Glycine (G)	U	
	GUC		GCC		GAC		GGC		C	
	GUA		GCA		GAA		GGA		A	
	GUG		GCG		GAG		GGG		G	

...	acc	ATG	GTG	CTG	TCT	...	TAA	ttc
...	●	M						

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1st base	2nd base						3rd base
	U		C	A		G	
U	UUU	Phenylalanine (F)	UCU	UAU	Tyrosine (Y)	UGU	Cysteine (C )
	UUC		UCC			UGC	
	UUA	Leucine (L)	UCA	UAA	stop codon	UGA	stop codon
	UUG		UCG	UAG		UGG	Tryptophan (W)
C	CUU	Leucine (L)	CCU	CAU	Histidine (H)	CGU	Arginine (R )
	CUC		CCC	CAC		CGC	
	CUA	Proline (P)	CCA	CAA	Glutamine (Q)	CGA	
	CUG		CCG	CAG		CGG	
A	AUU	Isoleucine (I)	ACU	AAU	Asparagine (N)	AGU	Serine (S)
	AUC		ACC	AAC		AGC	Serine (S)
	AUA	Methionine (M) & start codon	ACA	AAA	Lysine (K)	AGA	Arginine (R )
	AUG		ACG	AAG		AGG	Arginine (R )
G	GUU	Valine (V)	GCU	GAU	Aspartic Acid (D)	GGU	Glycine (G)
	GUC		GCC	GAC		GGC	
	GUA	Alanine (A)	GCA	GAA	Glutamic Acid (E)	GGA	
	GUG		GCG	GAG		GGG	

...	acc	ATG	GTG	CTG	TCT	...	TAA	ttc
...	●	M	V					

# Genetic code

1st base	2nd base				3rd base
	U	C	A	G	
U	UUU	UCU	UAU	UGU	U
	UUC	UCC	Tyrosine (Y)	UGC	C
	UUA	UCA	UAA	UGA	A
	UUG	UCG	stop codon	UGG	G
C	CUU	CCU	CAU	CGU	U
	CUC	CCC	Histidine (H)	CGC	C
	CUA	CCA	CAA	CGA	A
	CUG	CCG	Glutamine (Q)	CGG	G
A	AUU	ACU	AAU	AGU	U
	AUC	ACC	Asparagine (N)	AGC	C
	AUA	ACA	AAA	AGA	A
	AUG	ACG	Lysine (K)	AGG	G
G	GUU	GCU	GAU	GGU	U
	GUC	GCC	Aspartic Acid (D)	GGC	C
	GUA	GCA	GAA	GGA	A
	GUG	GCG	Glutamic Acid (E)	GGG	G

...	acc	ATG	GTG	CTG	TCT	...	TAA	ttc
...	●	M	V	L				

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	U		C	A		G	
U	UUU	Phenylalanine (F)	UCU	UAU	Tyrosine (Y)	UGU	Cysteine (C )
	UUC		UCC			UGC	
	UUA	Leucine (L)	UCA	UAA	stop codon	UGA	stop codon
	UUG		UCG	UAG		UGG	Tryptophan (W)
C	CUU	Leucine (L)	CCU	CAU	Histidine (H)	CGU	Arginine (R )
	CUC		CCC	CAC		CGC	
	CUA	Proline (P)	CCA	CAA	Glutamine (Q)	CGA	
	CUG		CCG	CAG		CGG	
A	AUU	Isoleucine (I)	ACU	AAU	Asparagine (N)	AGU	Serine (S)
	AUC		ACC	AAC		AGC	Serine (S)
	AUA	Methionine (M) & start codon	ACA	AAA	Lysine (K)	AGA	Arginine (R )
	AUG		ACG	AAG		AGG	Arginine (R )
G	GUU	Valine (V)	GCU	GAU	Aspartic Acid (D)	GGU	Glycine (G)
	GUC		GCC	GAC		GGC	
	GUA	Alanine (A)	GCA	GAA	Glutamic Acid (E)	GGA	
	GUG		GCG	GAG		GGG	

...	acc	ATG	GTG	CTG	TCT	...	TAA	ttc
...	●	M	V	L	S			

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	UUG		UCG	UAG		UGG	Tryptophan (W)
C	CUU	Leucine (L)	CCU	CAU	Histidine (H)	CGU	Arginine (R )
	CUC		CCC	CAC		CGC	
	CUA	Proline (P)	CCA	CAA	Glutamine (Q)	CGA	
	CUG		CCG	CAG		CGG	
A	AUU	Isoleucine (I)	ACU	AAU	Asparagine (N)	AGU	Serine (S)
	AUC		ACC	AAC		AGC	Serine (S)
	AUA	Methionine (M) & start codon	ACA	AAA	Lysine (K)	AGA	Arginine (R )
	AUG		ACG	AAG		AGG	Arginine (R )
G	GUU	Valine (V)	GCU	GAU	Aspartic Acid (D)	GGU	Glycine (G)
	GUC		GCC	GAC		GGC	
	GUA	Alanine (A)	GCA	GAA	Glutamic Acid (E)	GGA	
	GUG		GCG	GAG		GGG	

...	acc	ATG	GTG	CTG	TCT	...	TAA	ttc
...	●	M	V	L	S	...		



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	CUC		CCC	CAC		CGC	
	CUA	Proline (P)	CCA	CAA	Glutamine (Q)	CGA	
	CUG		CCG	CAG		CGG	
A	AUU	Isoleucine (I)	ACU	AAU	Asparagine (N)	AGU	Serine (S)
	AUC		ACC	AAC		AGC	Serine (S)
	AUA	Methionine (M) & start codon	ACA	AAA	Lysine (K)	AGA	Arginine (R )
	AUG		ACG	AAG		AGG	Arginine (R )
G	GUU	Valine (V)	GCU	GAU	Aspartic Acid (D)	GGU	Glycine (G)
	GUC		GCC	GAC		GGC	
	GUA	Alanine (A)	GCA	GAA	Glutamic Acid (E)	GGA	
	GUG		GCG	GAG		GGG	

...	acc	ATG	GTG	CTG	TCT	...	TAA	ttc
...	●	M	V	L	S	...	X	

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	UUA	Leucine (L)	UCA	UAA	stop codon	UGA	stop codon
	UUG		UCG	UAG		UGG	Tryptophan (W)
C	CUU	Leucine (L)	CCU	CAU	Histidine (H)	CGU	Arginine (R )
	CUC		CCC	CAC		CGC	
	CUA	Proline (P)	CCA	CAA	Glutamine (Q)	CGA	
	CUG		CCG	CAG		CGG	
A	AUU	Isoleucine (I)	ACU	AAU	Asparagine (N)	AGU	Serine (S)
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	AUA	Methionine (M) & start codon	ACA	AAA	Lysine (K)	AGA	Arginine (R )
	AUG		ACG	AAG		AGG	Arginine (R )
G	GUU	Valine (V)	GCU	GAU	Aspartic Acid (D)	GGU	Glycine (G)
	GUC		GCC	GAC		GGC	
	GUA	Alanine (A)	GCA	GAA	Glutamic Acid (E)	GGA	
	GUG		GCG	GAG		GGG	

...	acc	ATG	GTG	CTG	TCT	...	TAA	ttc
...	●	M	V	L	S	...	X	●

# Fréquence de codage des AA

Acide Aminé	L	R	V	S	P	T	A	G	I	X
Nb codons	6	6	4	4	4	4	4	4	3	3

Acide Aminé	Y	H	Q	N	K	D	E	C	S	M	W
Nb codons	2	2	2	2	2	2	2	2	2	1	1