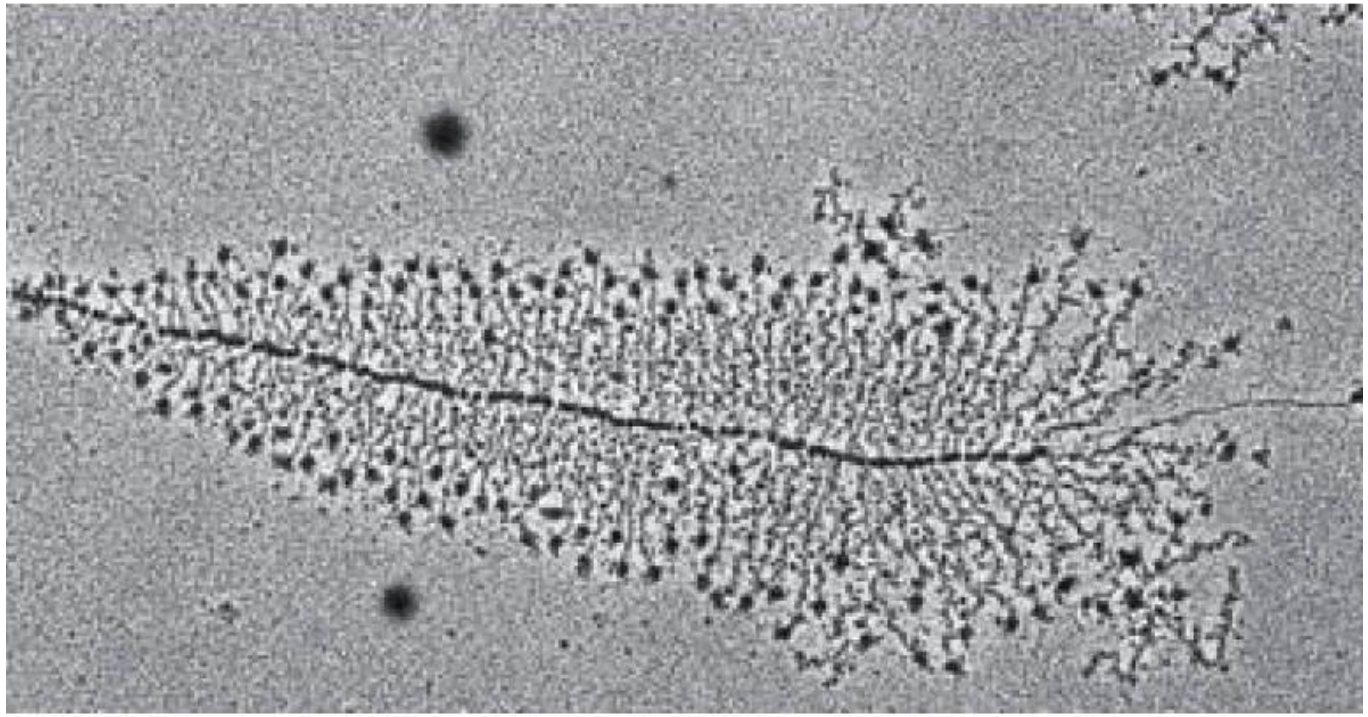
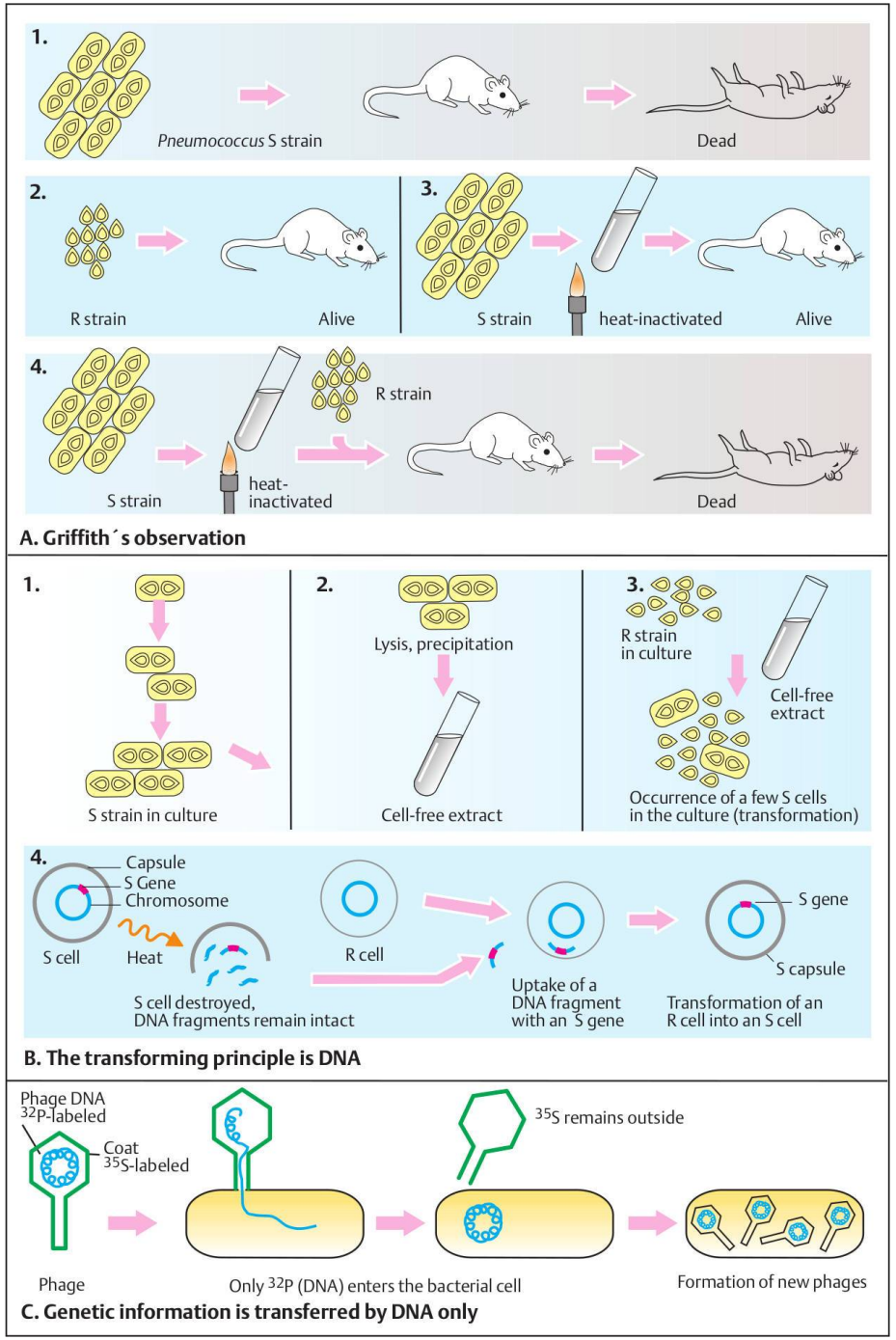
G 01 :
Organisation et expression du genome



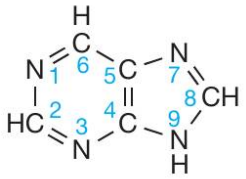
Introduction

- Définition genome
- Darwin
- Mendel
- Morgan & Sutton
- Griffith
- Avery, MacLeod & McCarthy
- Hershey & Chase

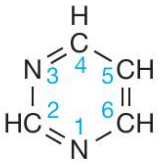


Bases azotées

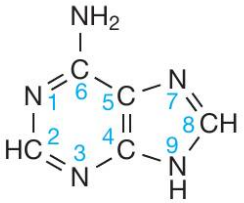
- Pyrimidine
  - Cytosine, Thymine, Uracile
- Purine
  - Adénine, Guanine



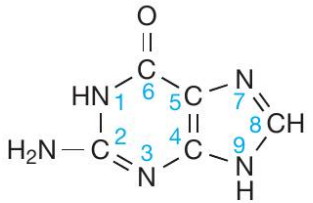
Purine



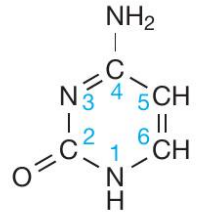
Pyrimidine



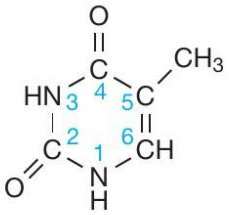
Adénine (A)



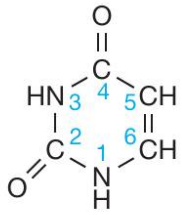
Guanine (G)



Cytosine (C)



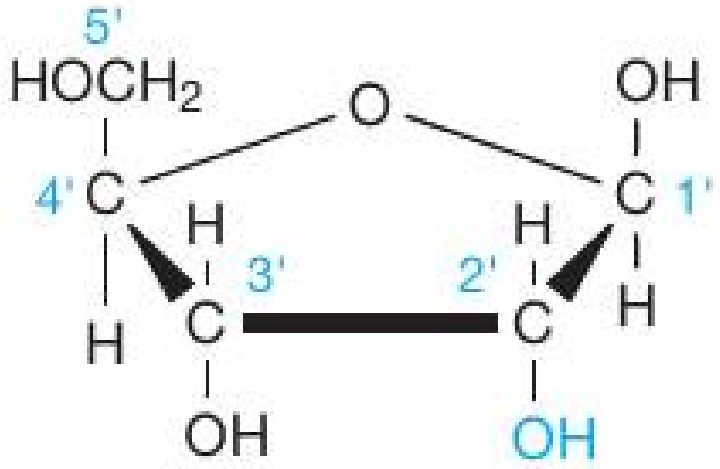
Thymine (T)



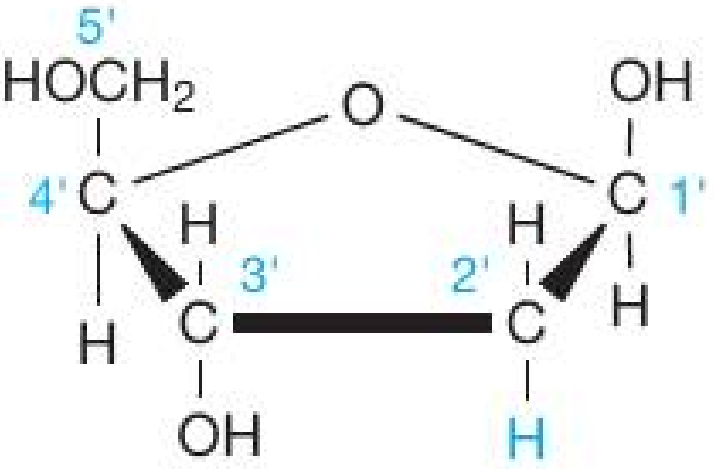
Uracile (U)

Sucre

- Pentose
- Ribose
- Desoxyribose
- Numérotation de carbones



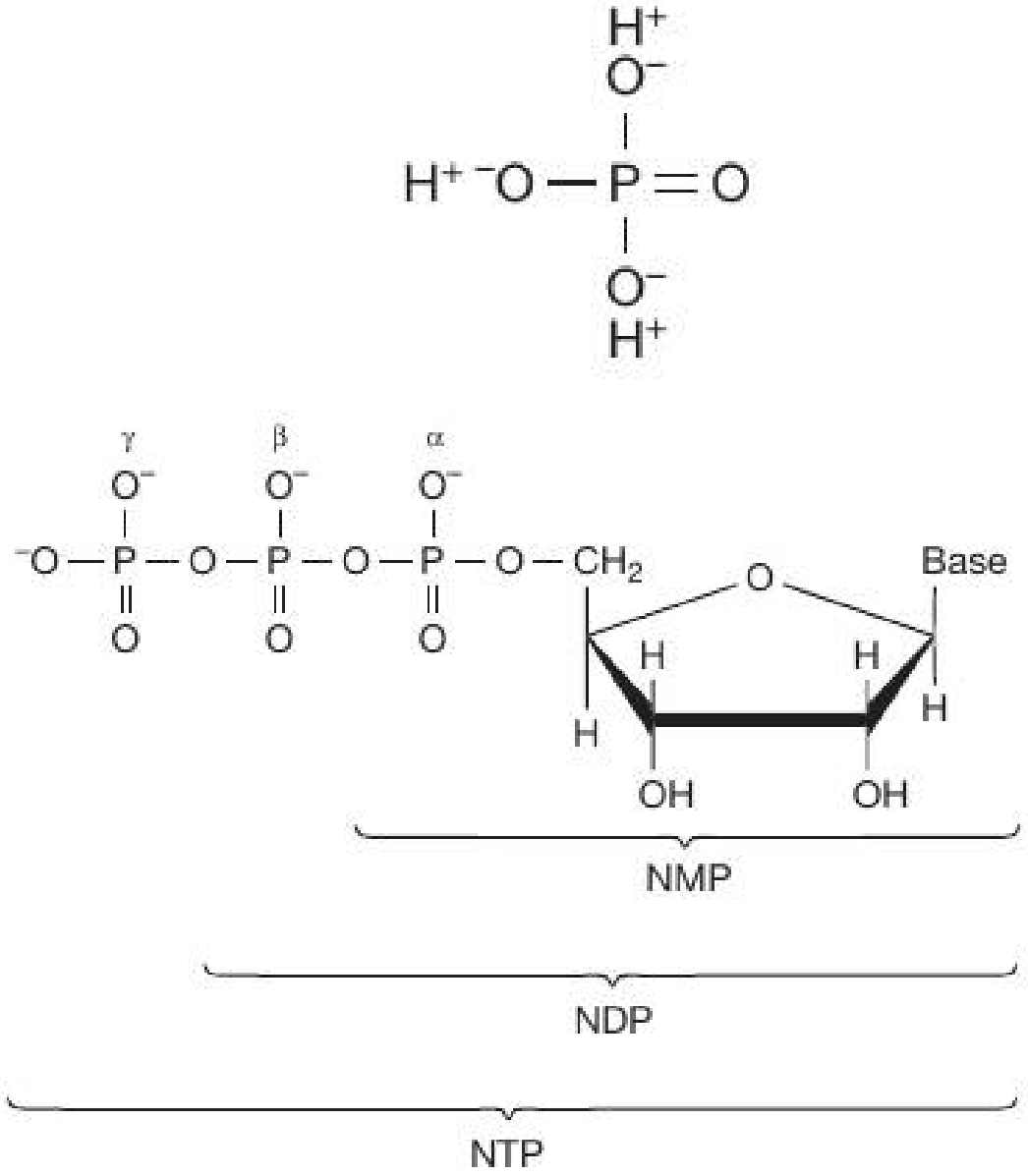
Ribose



Désoxyribose

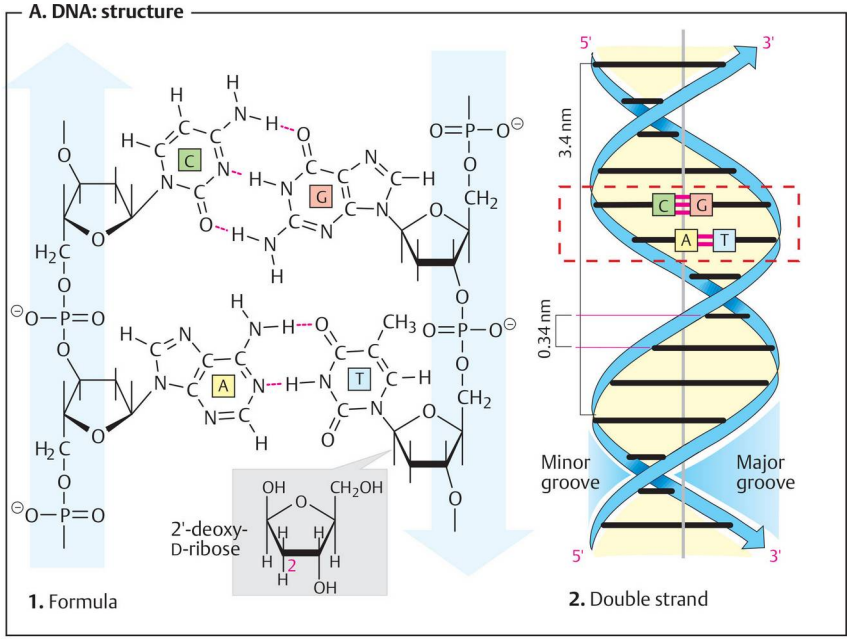
Phosphate

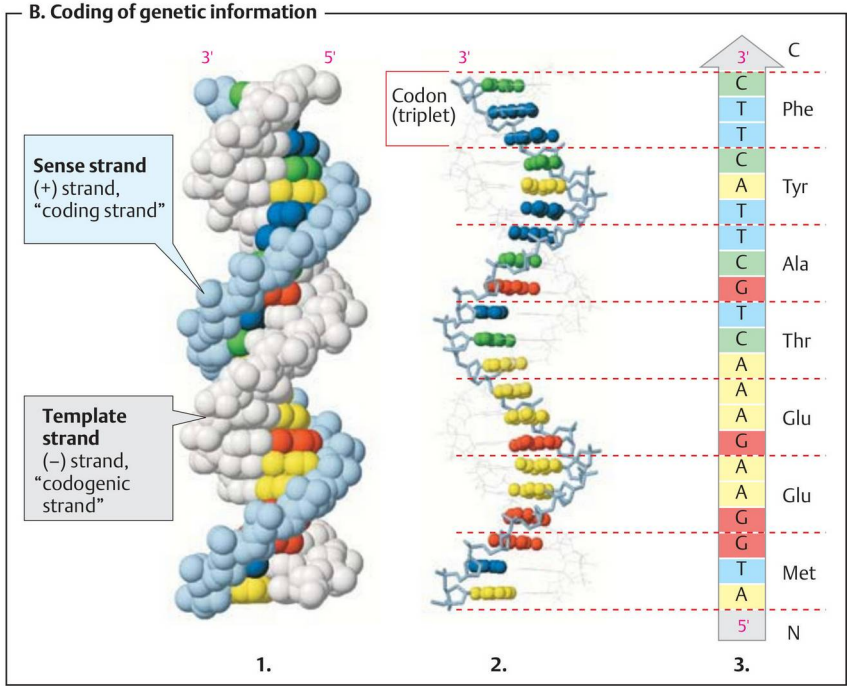
- Carbone 5’
- NMP
- NDP
- NTP
  - ATP, GTP



ADN

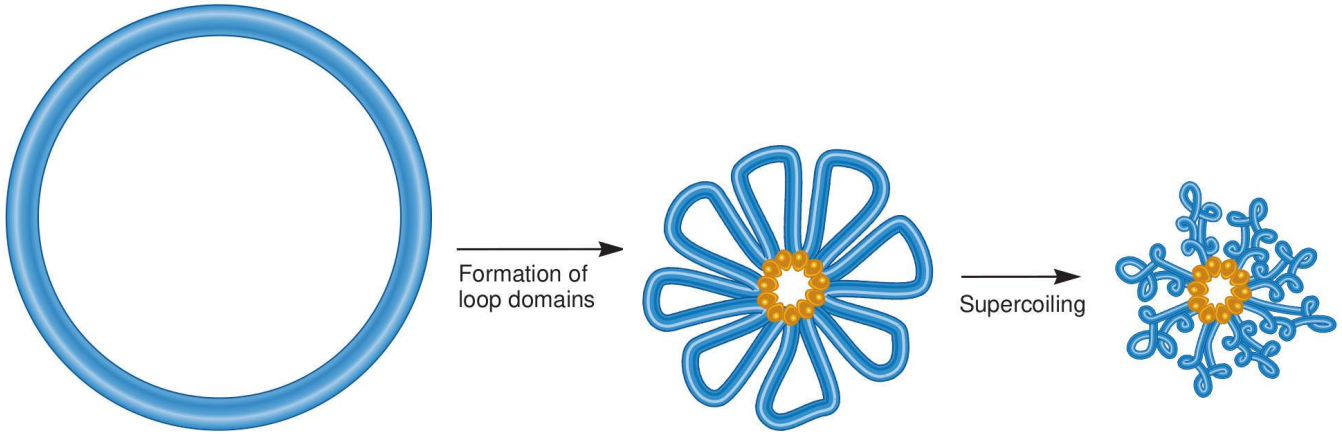
- Watson, Crick, Wilkins, Franklin
- Double hélice
- Brins antiparallèles
- Complémentarité des bases
- Montants et barreaux d'échelles





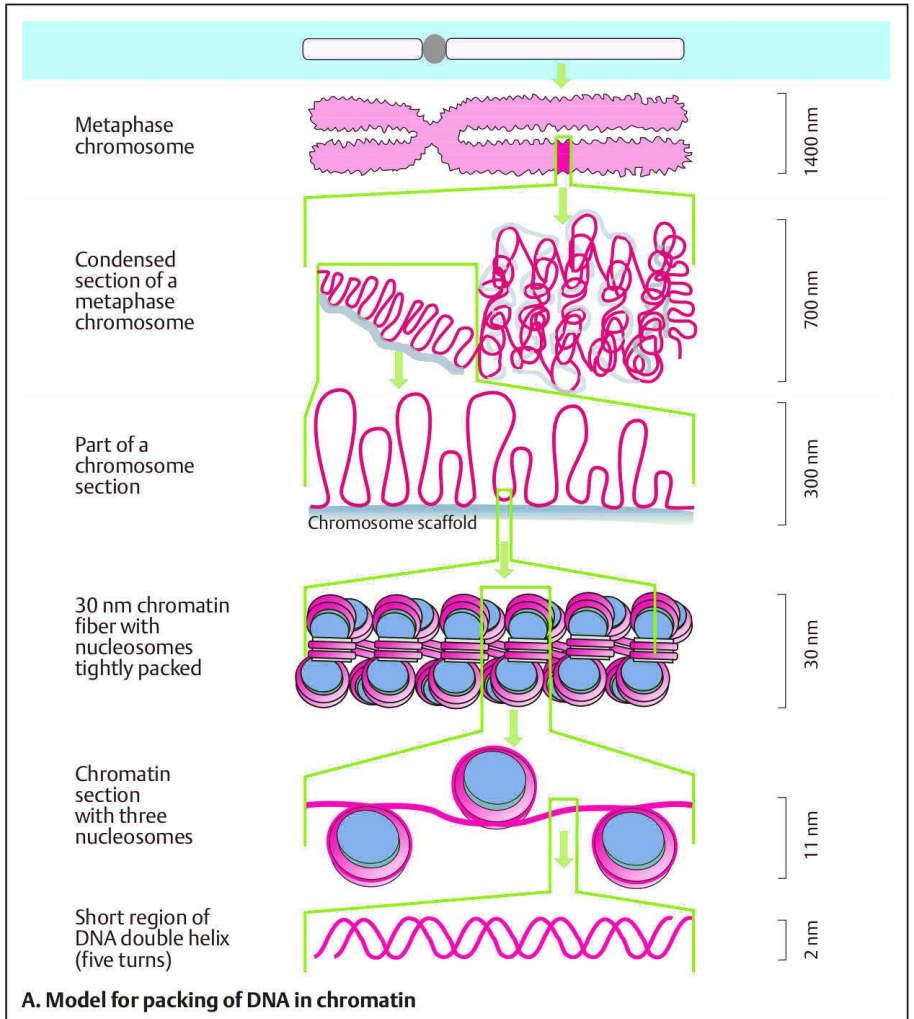
Chromosome bactérien

- Circulaire
- Double hélice
- Nucléoide
- Protéine H-NS



Chromosome eucaryote

- Chromosome interphasique
- Euchromatine VS Hétérochromatine
- Fibre nucléosomique
- Histones
- Fibre de 30nm
- Charpente protéique

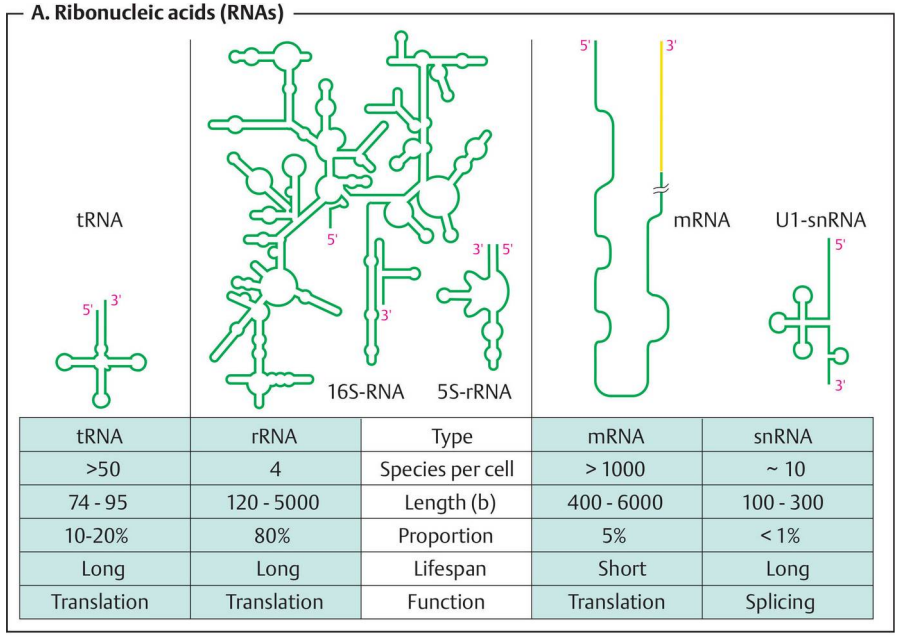


Localisation de l'ADN

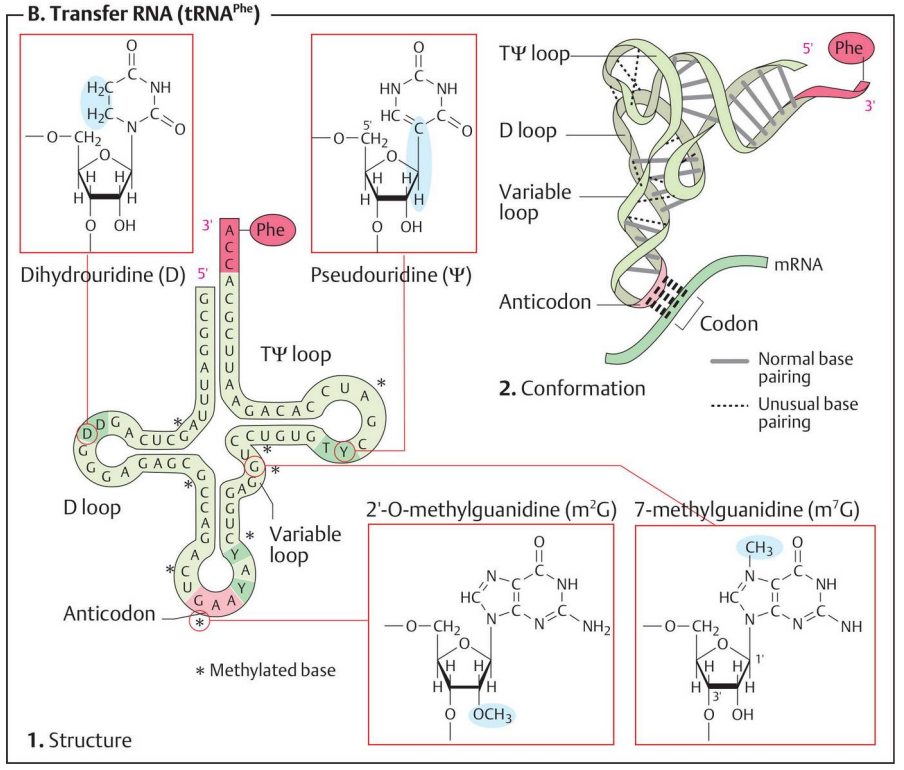
- Bactéries
  - Chromosome bactérien
  - Plasmides
- Eucaryotes
  - Noyau
  - Organites semi-autonomes

ARN

- ARNm
- ARNr
- ARNt



tRNA	rRNA	Type	mRNA	snRNA
>50	4	Species per cell	> 1000	~ 10
74 - 95	120 - 5000	Length (b)	400 - 6000	100 - 300
10-20%	80%	Proportion	5%	< 1%
Long	Long	Lifespan	Short	Long
Translation	Translation	Function	Translation	Splicing

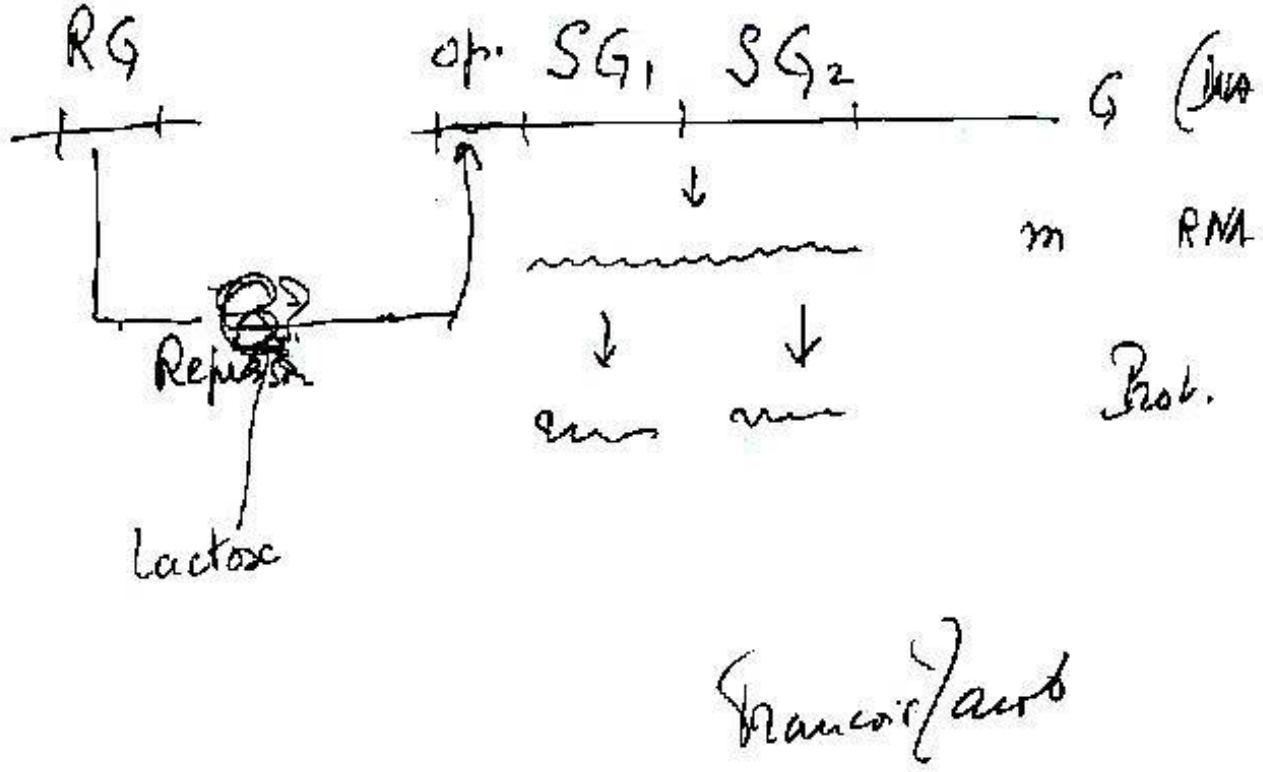


Gene

- Séquence codante = ORF
- Promoteur
- 5’UTR
- 3’UTR
- Séquences régulatrices
  - Enhancer
  - Silencer
  - Insulator

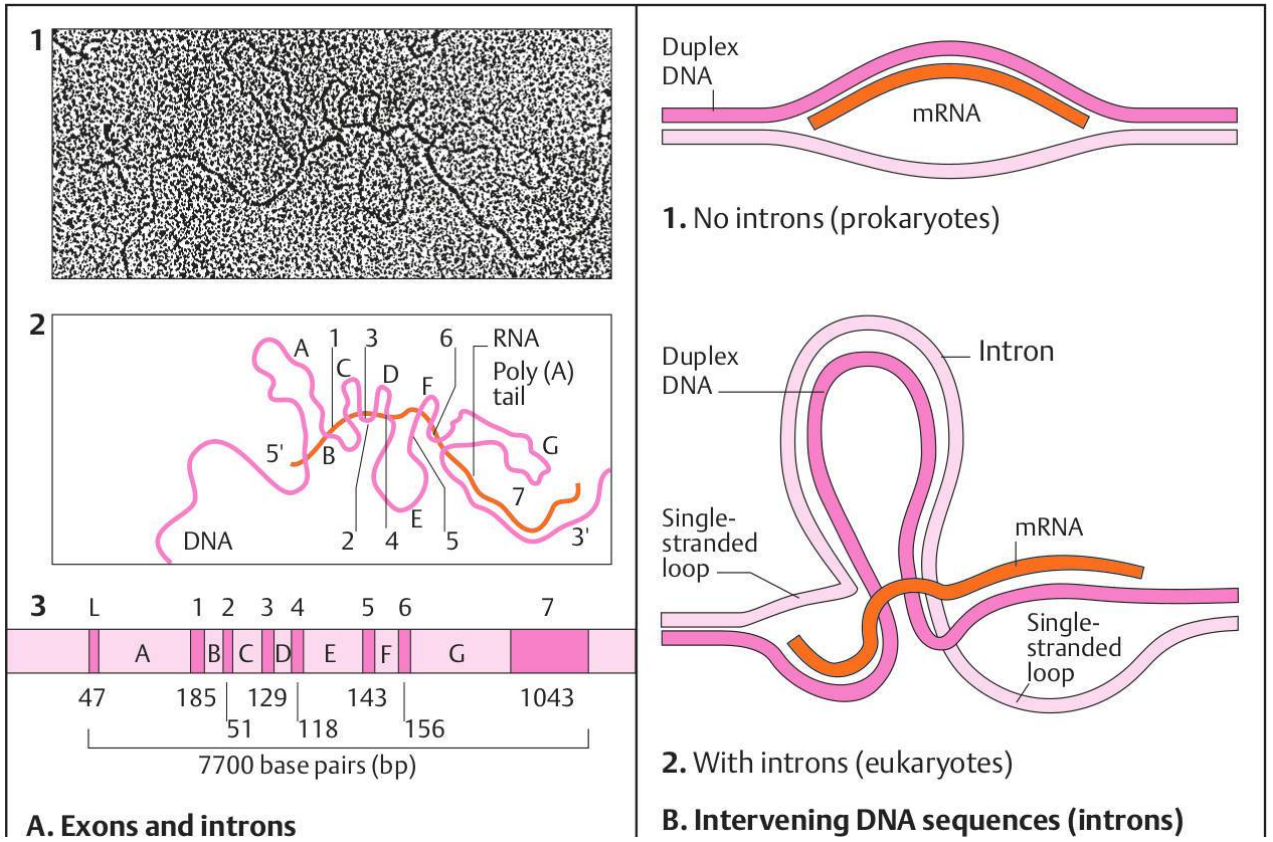
Operon

- Jacob & Monod
- Promoteur
- Operateur
- Plusieurs ORF
  - Exemple operon lactose
- ARN polycistronique



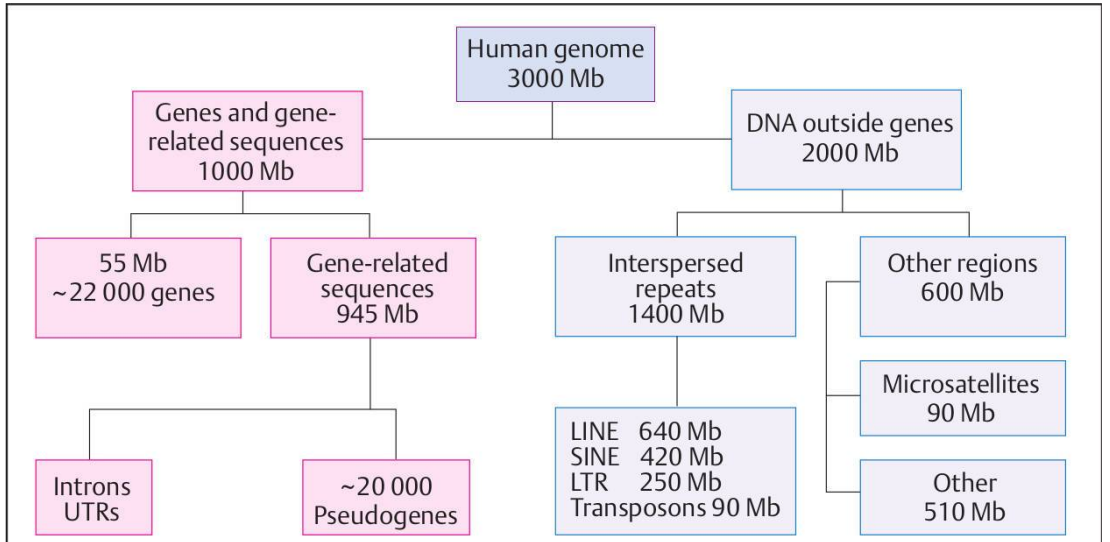
Genome eucaryote

- Gène eucaryote unique
  - Morcelé
  - Intron & Exon
- Séquences hautement répétés = satellite
- Séquence moyennement répétés
  - Gènes en tandem
  - Famille multigénique
  - Éléments génétiques mobiles

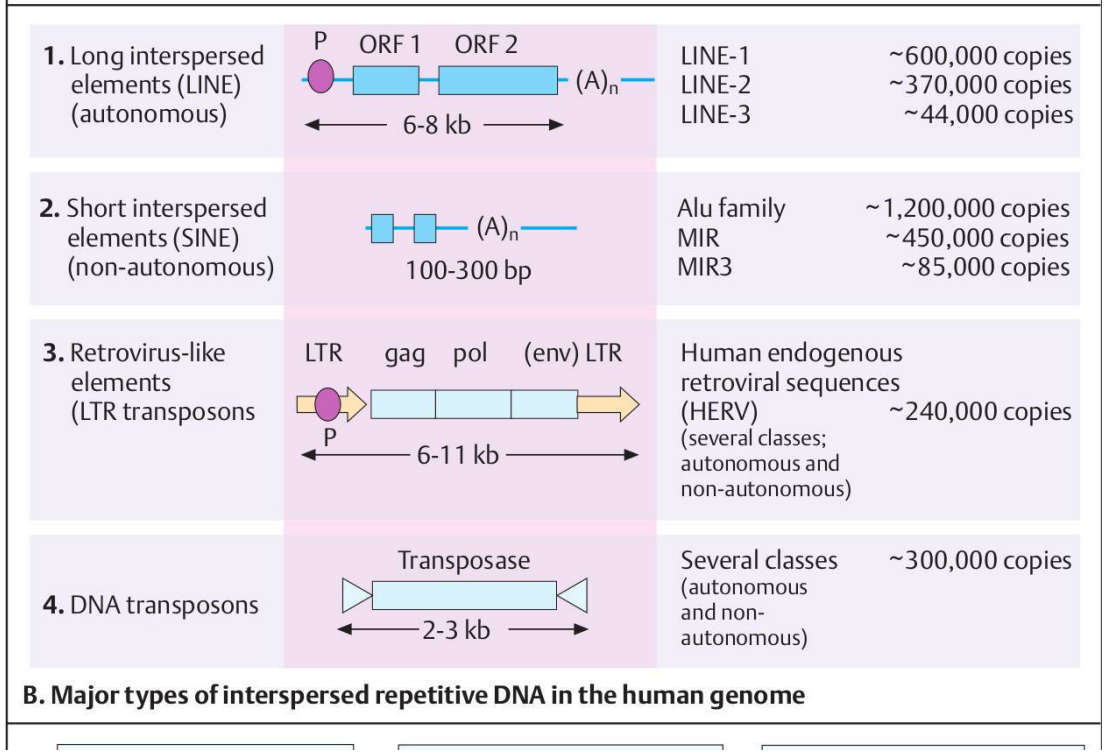


Genome eucaryote

- Gène eucaryote unique
  - Morcelé
  - Intron & Exon
- Séquences hautement répétés = satellite
- Séquence moyennement répétés
  - Gènes en tandem
  - Famille multigénique
  - Éléments génétiques mobiles



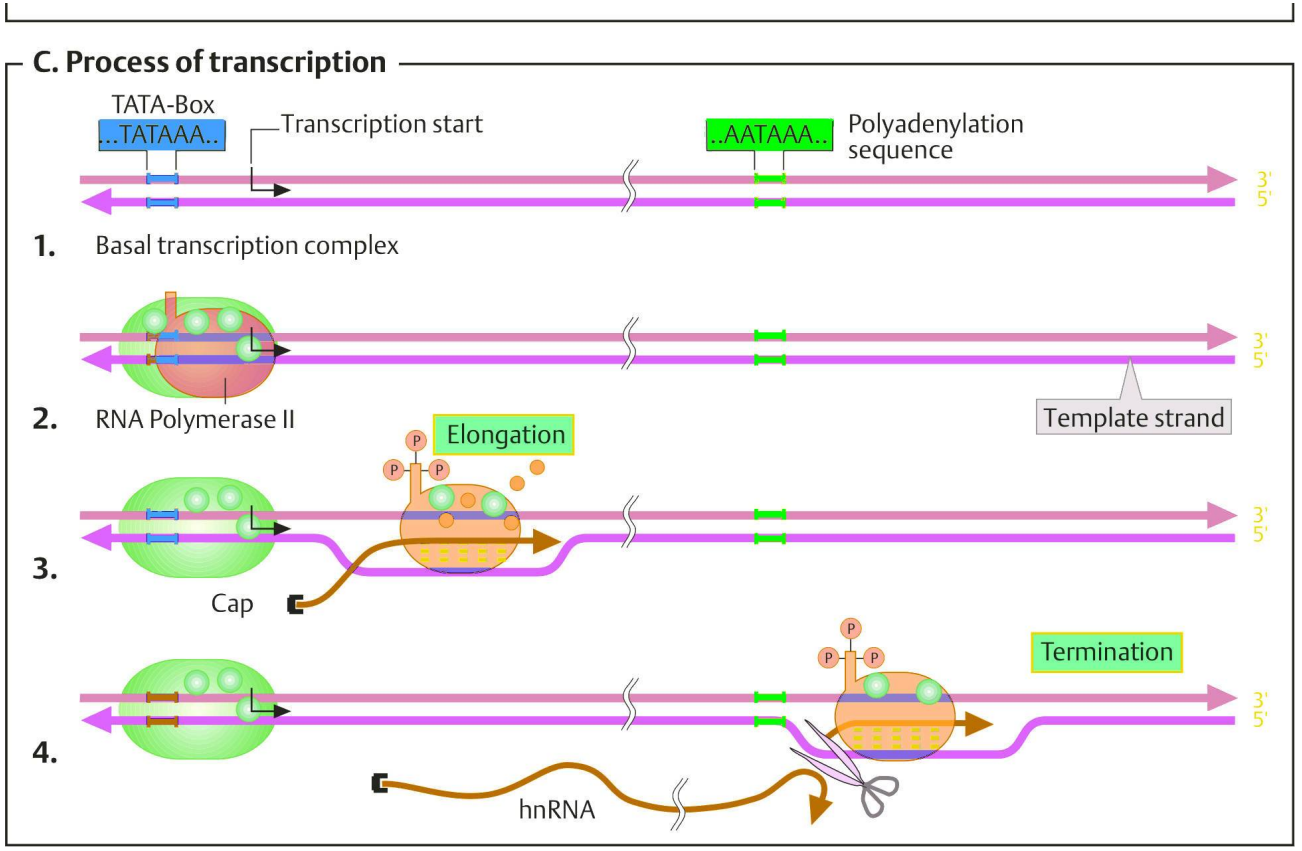
A. The types of sequence in the nuclear human genome



B. Major types of interspersed repetitive DNA in the human genome

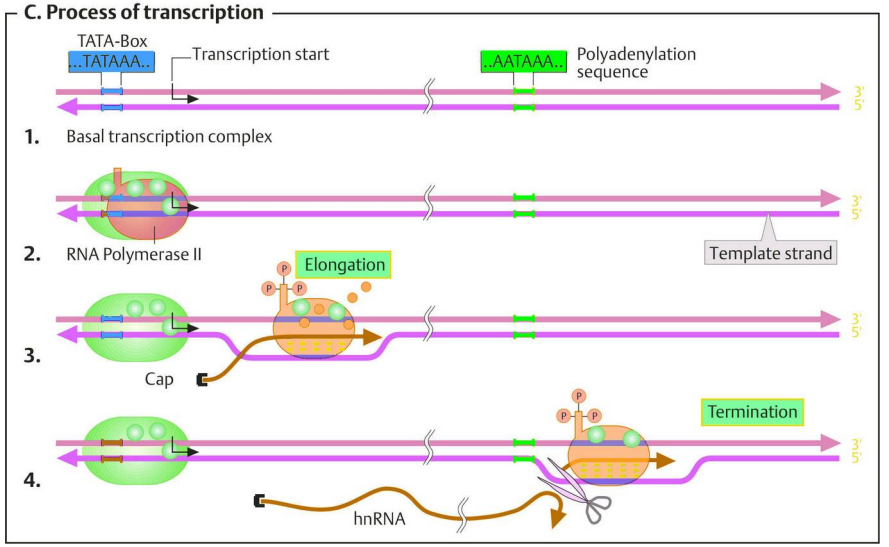
Transcription

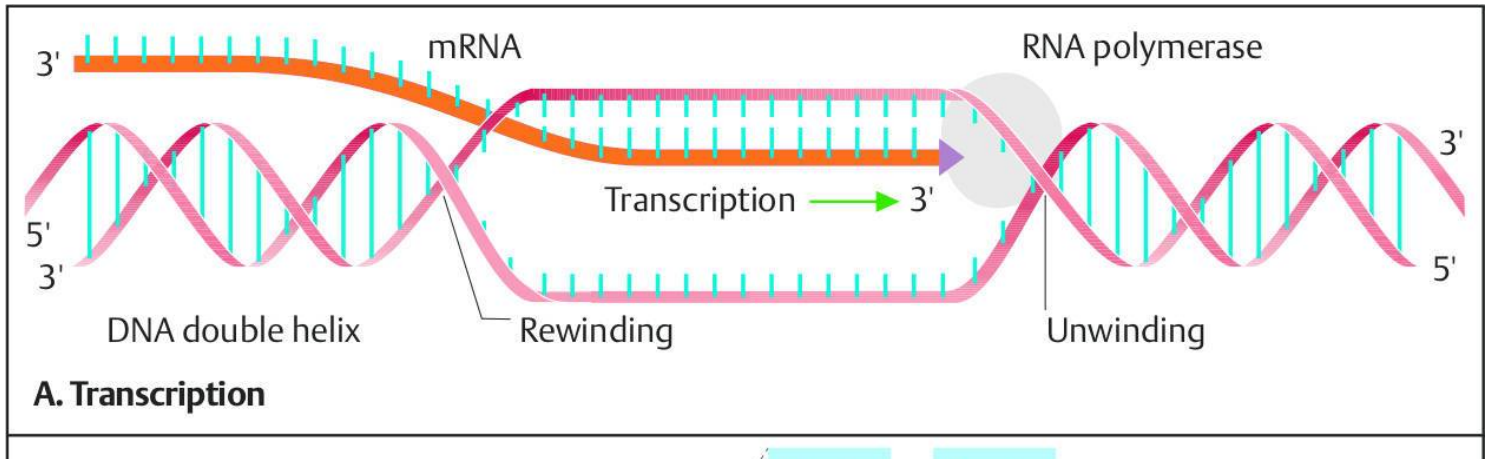
- ARN Pol II
- Promoteur
  - TATA box
  - TBP
  - (CAAT)
  - TFII
  - Phosphorylation



Elongation

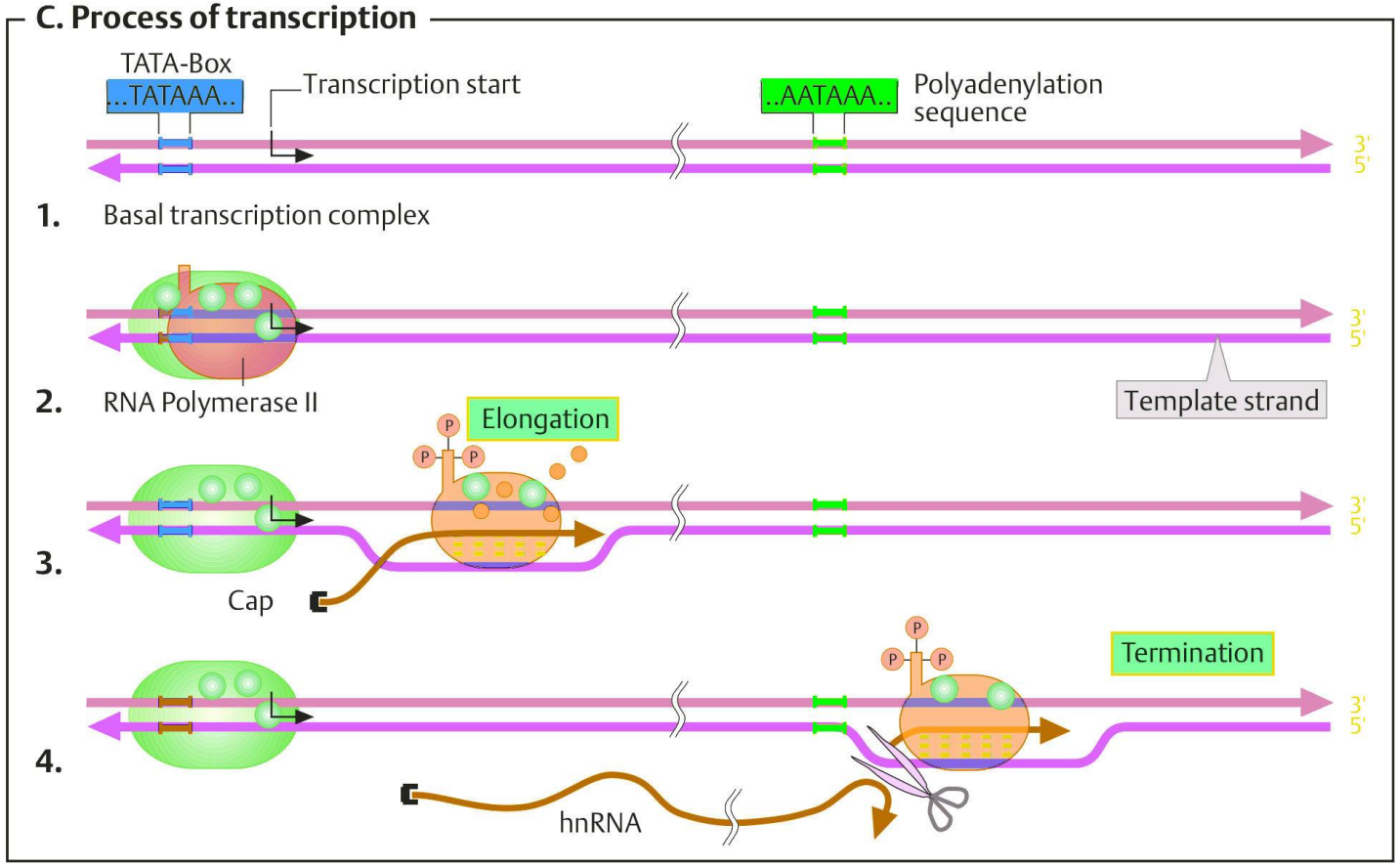
- ARN Pol II
- Sens 5′ → 3′
- 50nt/s
- 1 erreur/10 000nt
- Heteroduplex





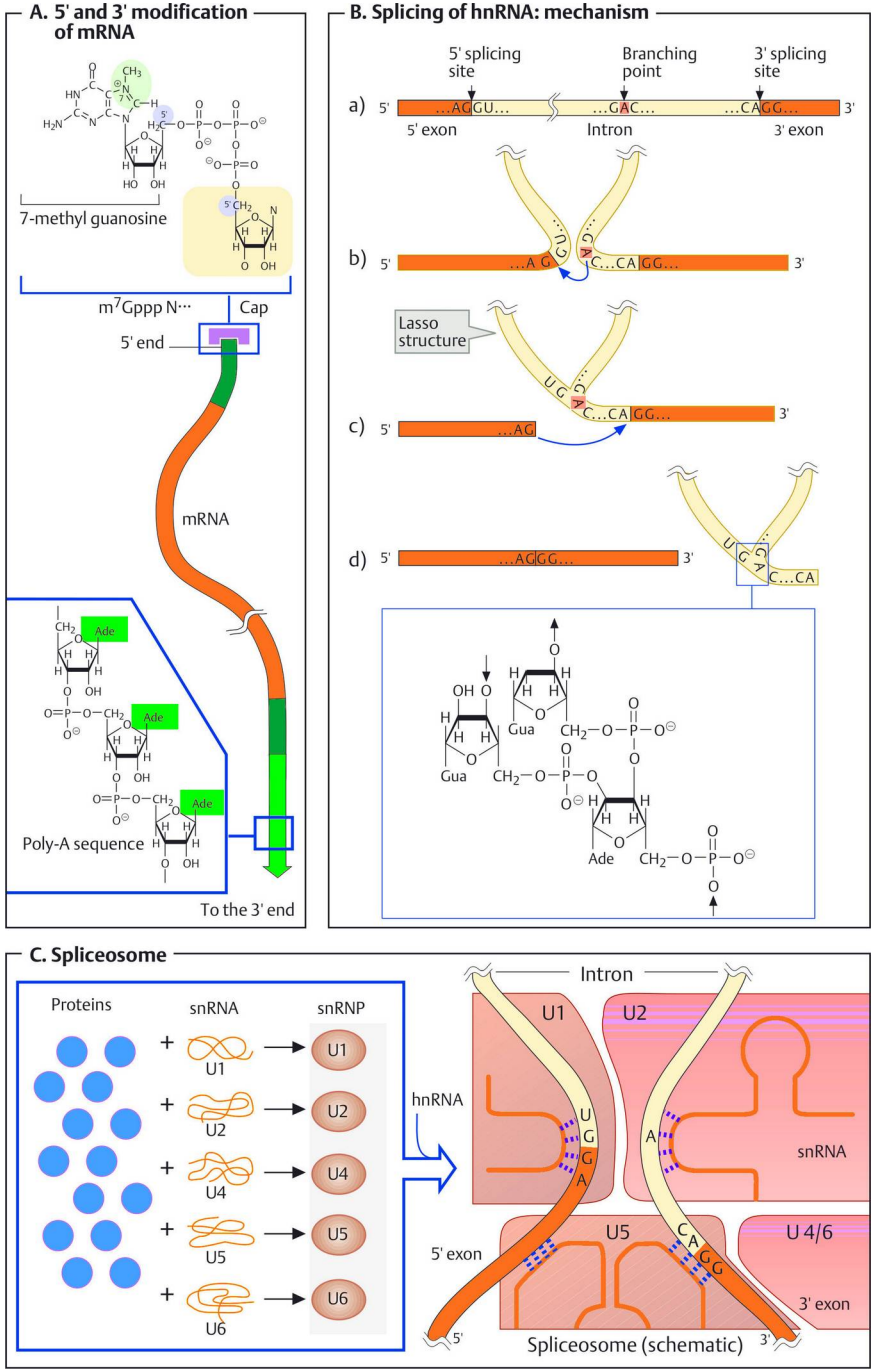
Terminaison

- Signal de polyadénylation
  - AAUAAA
  - CPSF
- Modèle torpille
- Modèle allostérique



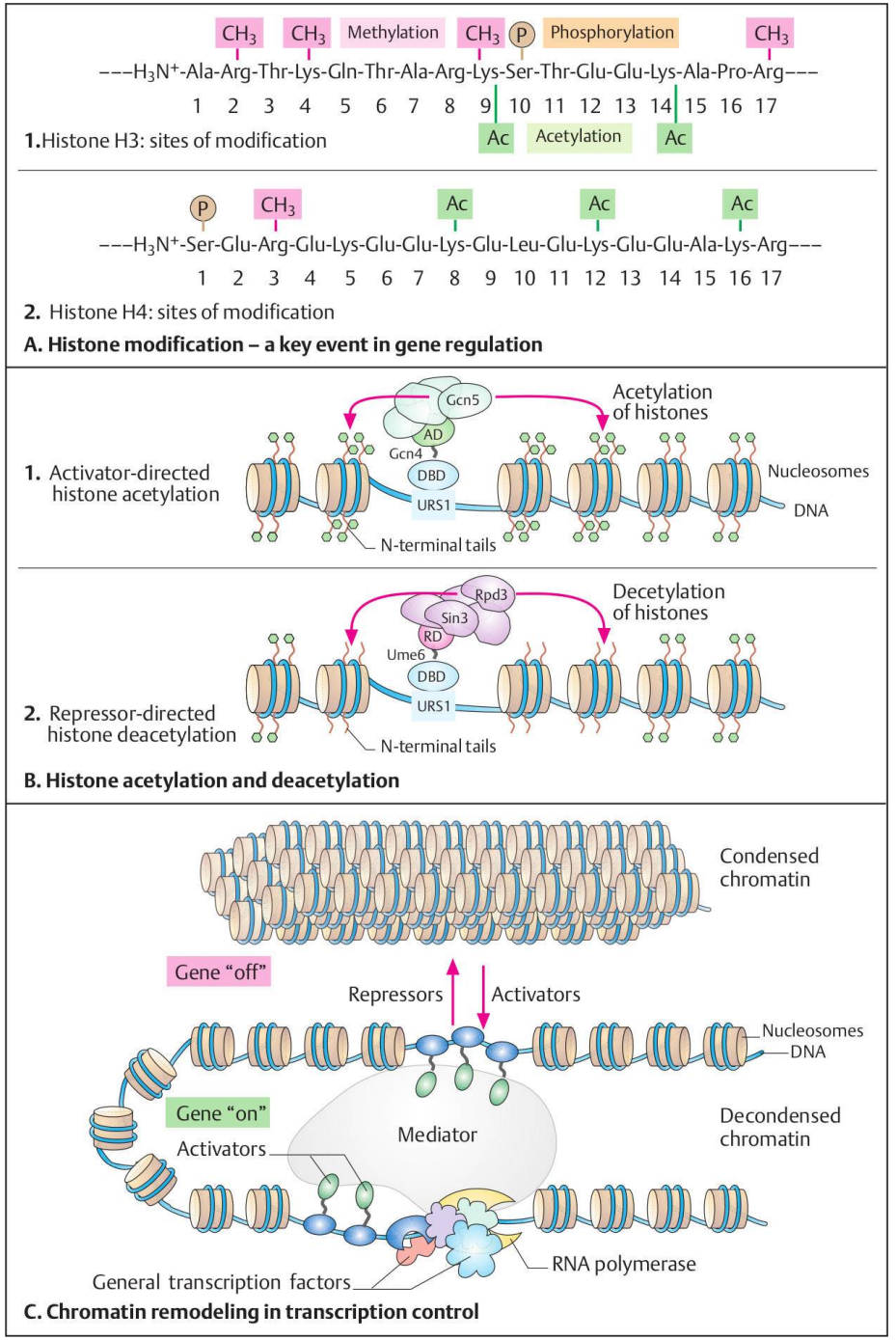
Maturation

- Coiffe de 7mG
- Polyadénylation
- Epissage



Controle

- Facteurs de transcription
- Hétérochromatine facultative
- Protéine de remodelage de la chromatine
- « Code histone »
- Méthylation de l'ADN



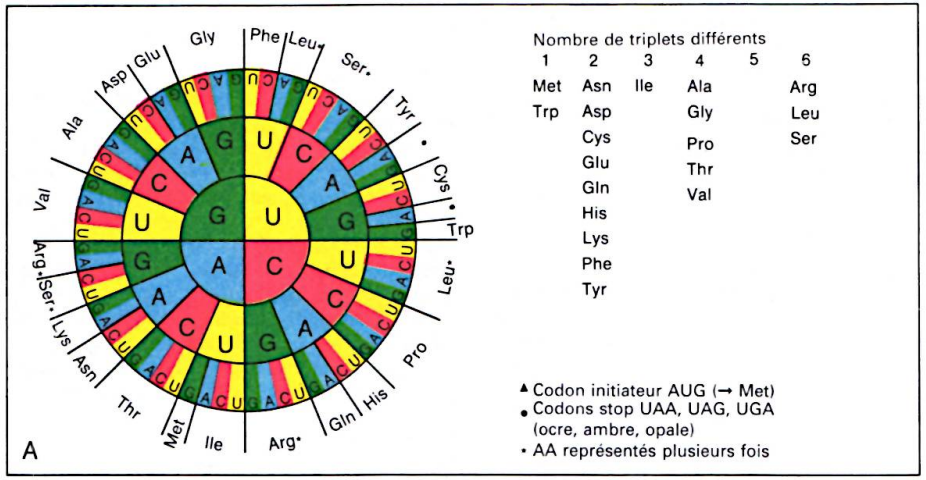
Code génétique

- 64 codons
- Codons stop
- Codon initiateur
- Code redondant ou dégénéré
- Code non-ambigu

nonpolar polar basic acidic (stop codon)

Standard genetic code

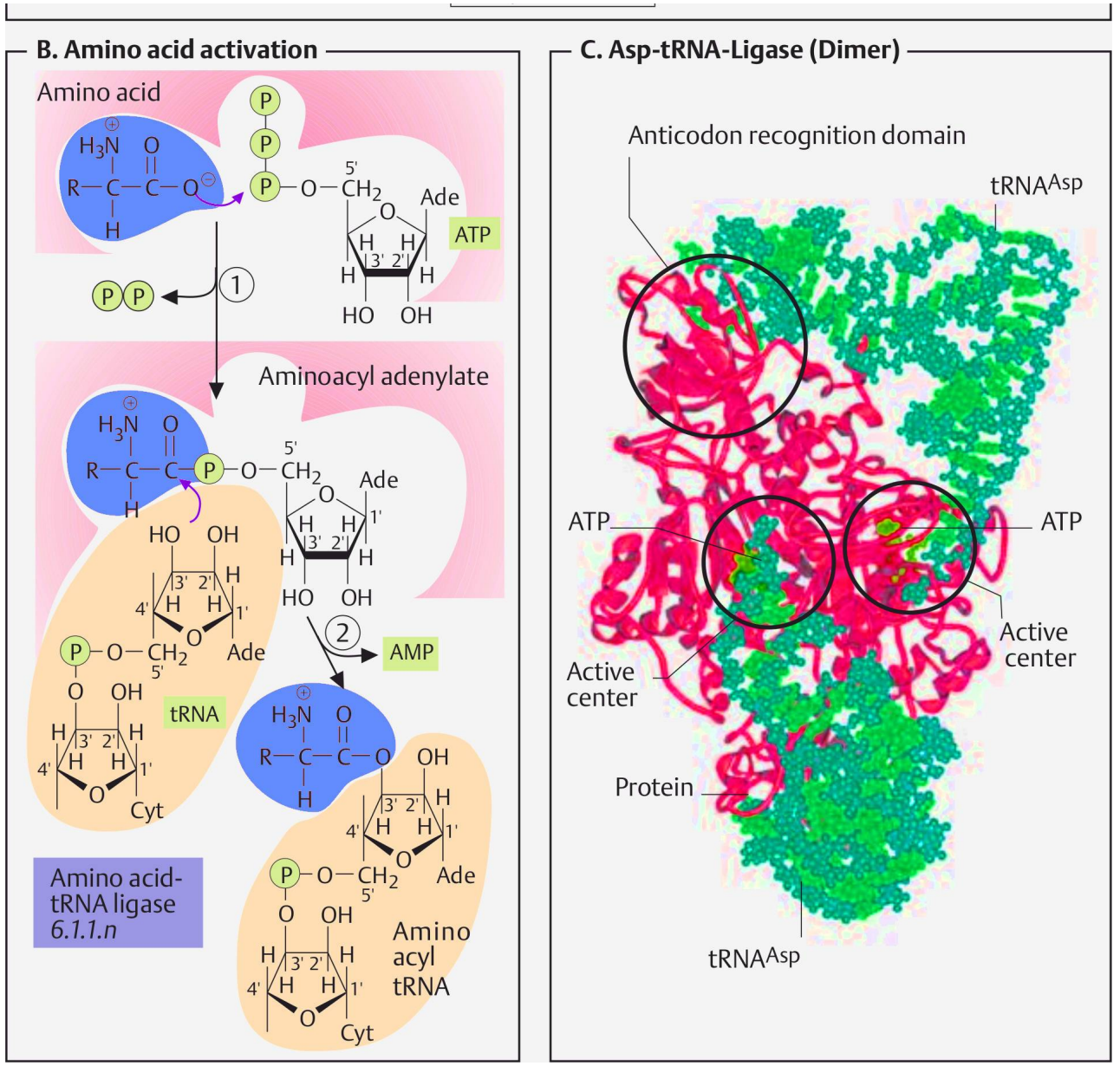
1st base	2nd base U		2nd base C		2nd base A		2nd base G		3rd base
U	UUU	(Phe/F) Phenylalanine	UCU	(Ser/S) Serine	UAU	(Tyr/Y) Tyrosine	UGU	(Cys/C) Cysteine	U
	UUC		UCC		UAC		UGC		C
	UUA	(Leu/L) Leucine	UCA		UAA	Stop (*Ochre*)	UGA	Stop (*Opal*)	A
	UUG		UCG		UAG	Stop (*Amber*)	UGG	(Trp/W) Tryptophan	G
C	CUU		CCU	(Pro/P) Proline	CAU	(His/H) Histidine	CGU	(Arg/R) Arginine	U
	CUC		CCC		CAC		CGC		C
	CUA		CCA		CAA	(Gln/Q) Glutamine	CGA		A
	CUG		CCG		CAG		CGG		G
A	AUU	(Ile/I) Isoleucine	ACU	(Thr/T) Threonine	AAU	(Asn/N) Asparagine	AGU	(Ser/S) Serine	U
	AUC		ACC		AAC		AGC		C
	AUA		ACA		AAA	(Lys/K) Lysine	AGA	(Arg/R) Arginine	A
	AUG[A]	(Met/M) Methionine	ACG		AAG		AGG		G
G	GUU	(Val/V) Valine	GCU	(Ala/A) Alanine	GAU	(Asp/D) Aspartic acid	GGU	(Gly/G) Glycine	U
	GUC		GCC		GAC		GGC		C
	GUA		GCA		GAA	(Glu/E) Glutamic acid	GGA		A
	GUG		GCG		GAG		GGG		G



Nomenclature des bases déterminant le code

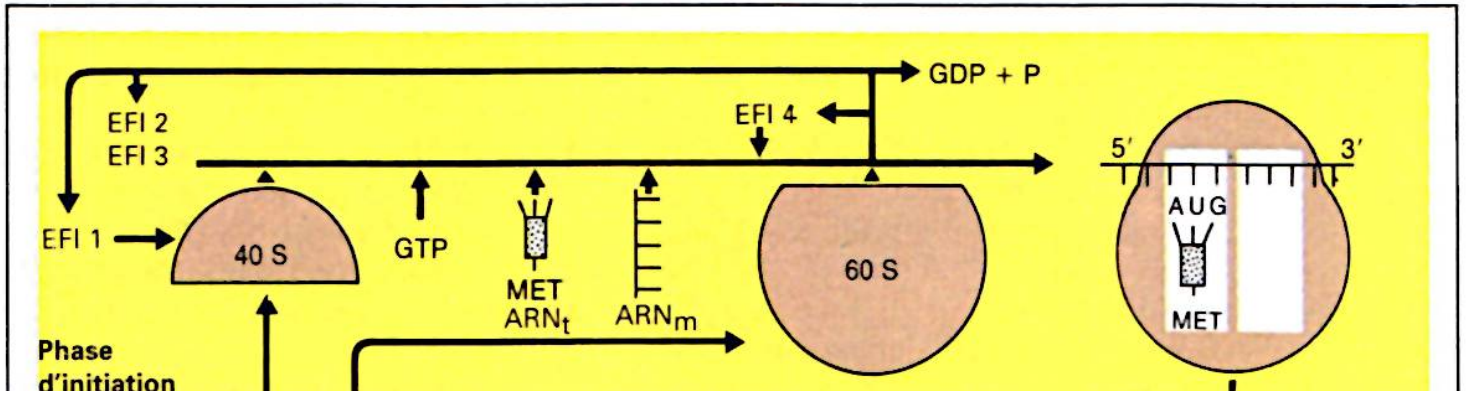
Charge de l'ARNt

- 2 étapes
- Wobble sur la 3ème base
- Double sélectivité



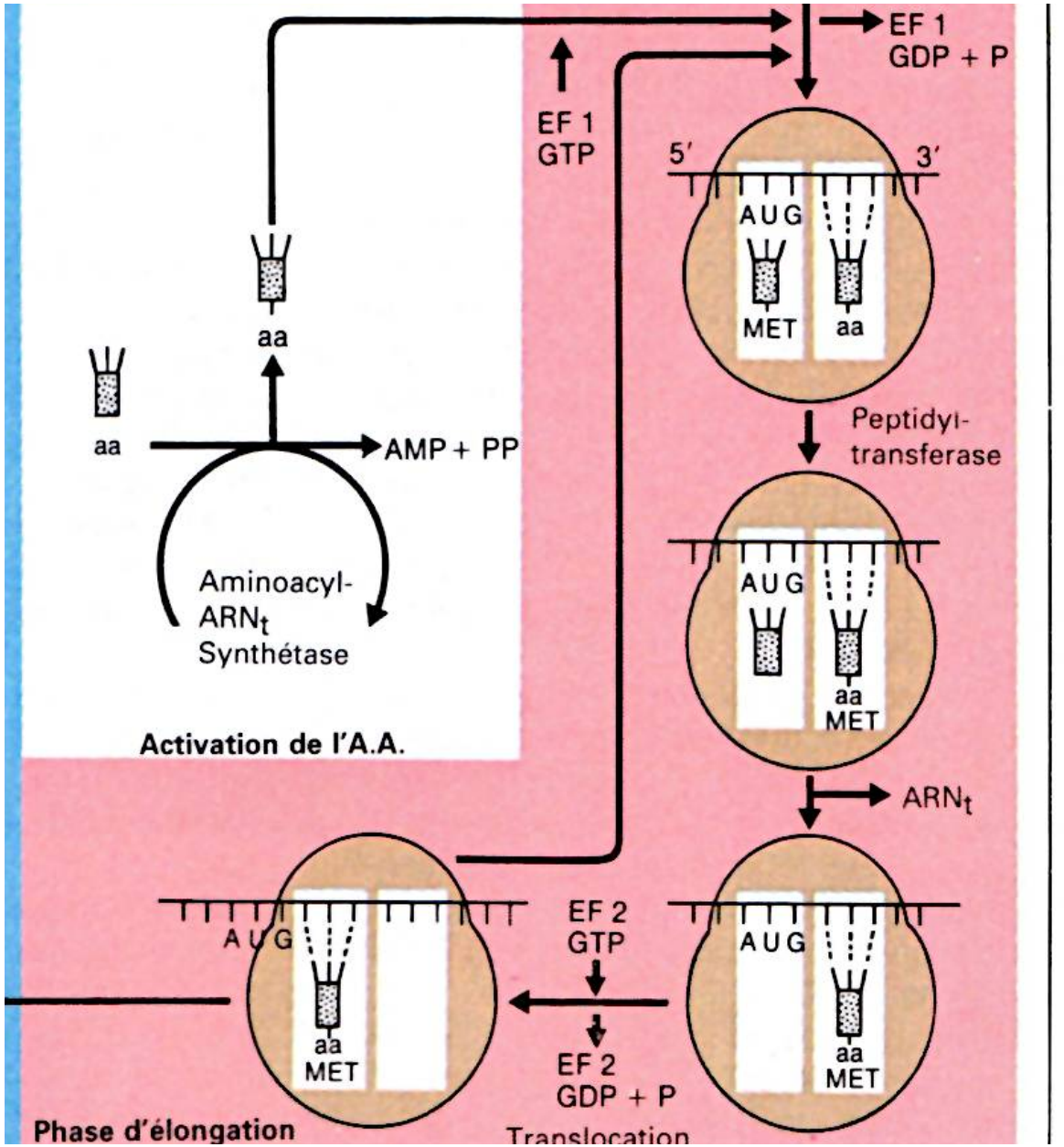
Initiation de la traduction

- IF-GTP+ARNti-met
- Fixation à la 40S dans le site P
- Fixation à l'ARNm
- Scan → AUG Kozak
- Fixation de la 60S



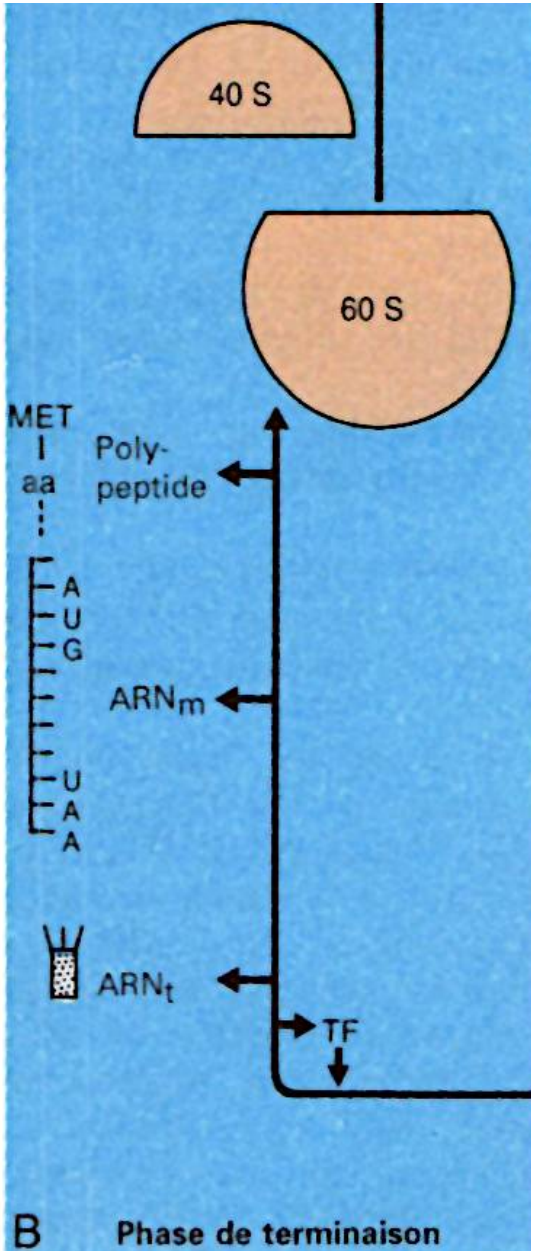
Elongation

- Arrivée de l'ARNt-AA dans le site A avec un EF-GTP
- Décodage : hydrolyse du GTP
- Activité peptidyl-transferase
- Un EF-GTP déplace le ribosome



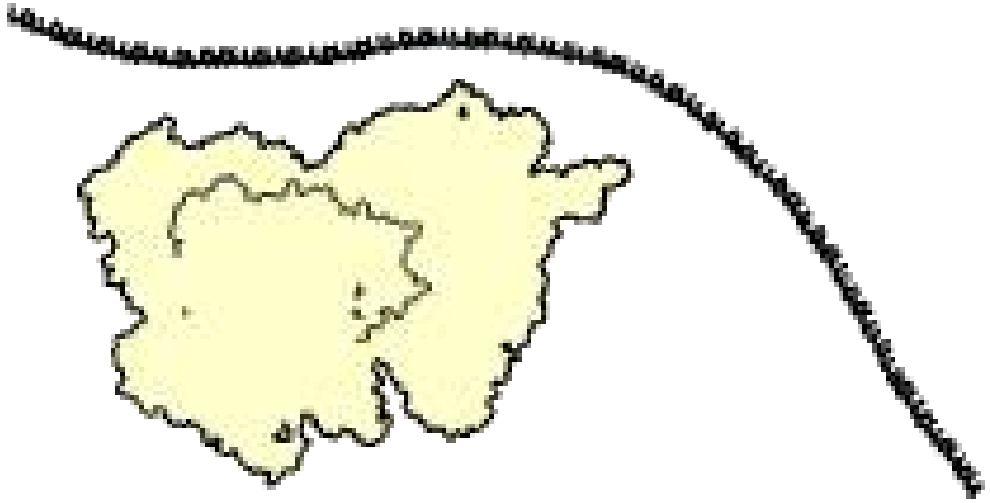
Terminaison

- Codon Stop
- Facteur de terminaison



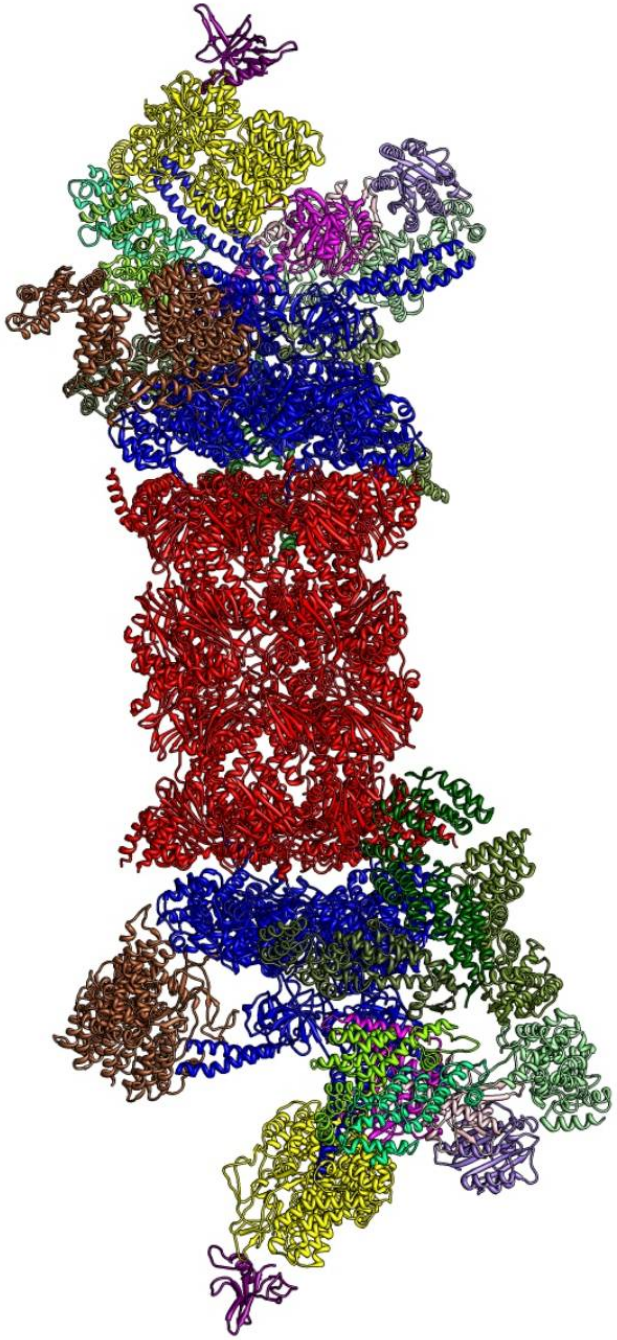
Adressage

- Co-traductionnel au REG
  - SRP
  - Translocon
- Post-traductionnel
  - Mitochondrie
  - Chloroplaste



Proteasome

- Ubiquitination
- Proteasome



Controle

- ARNi
- Drosha
- Dicer
- RISC