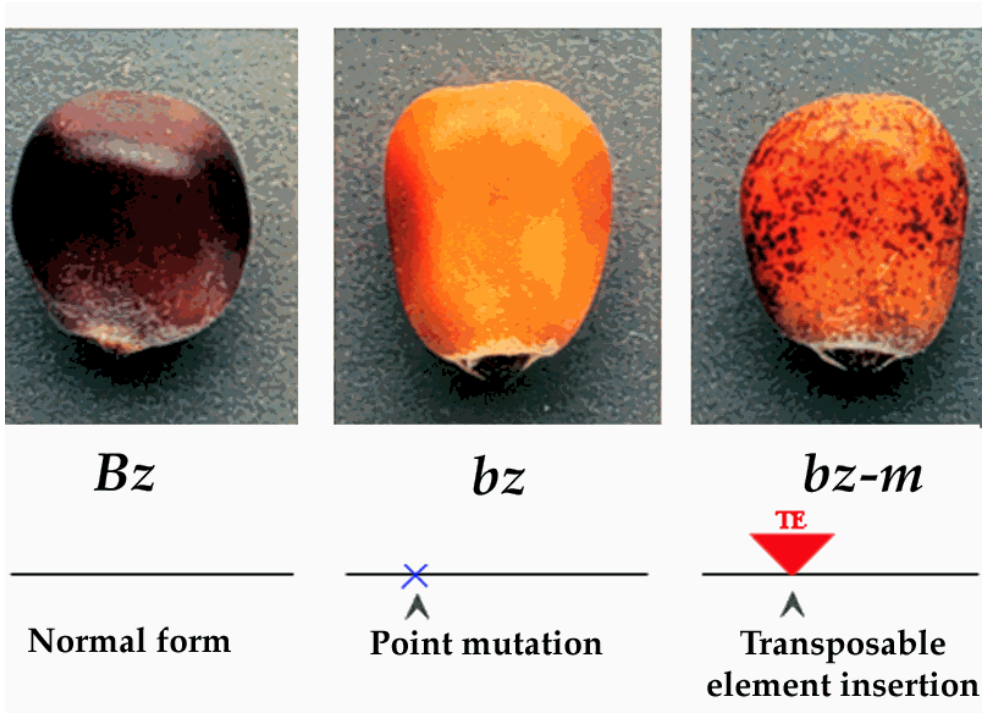
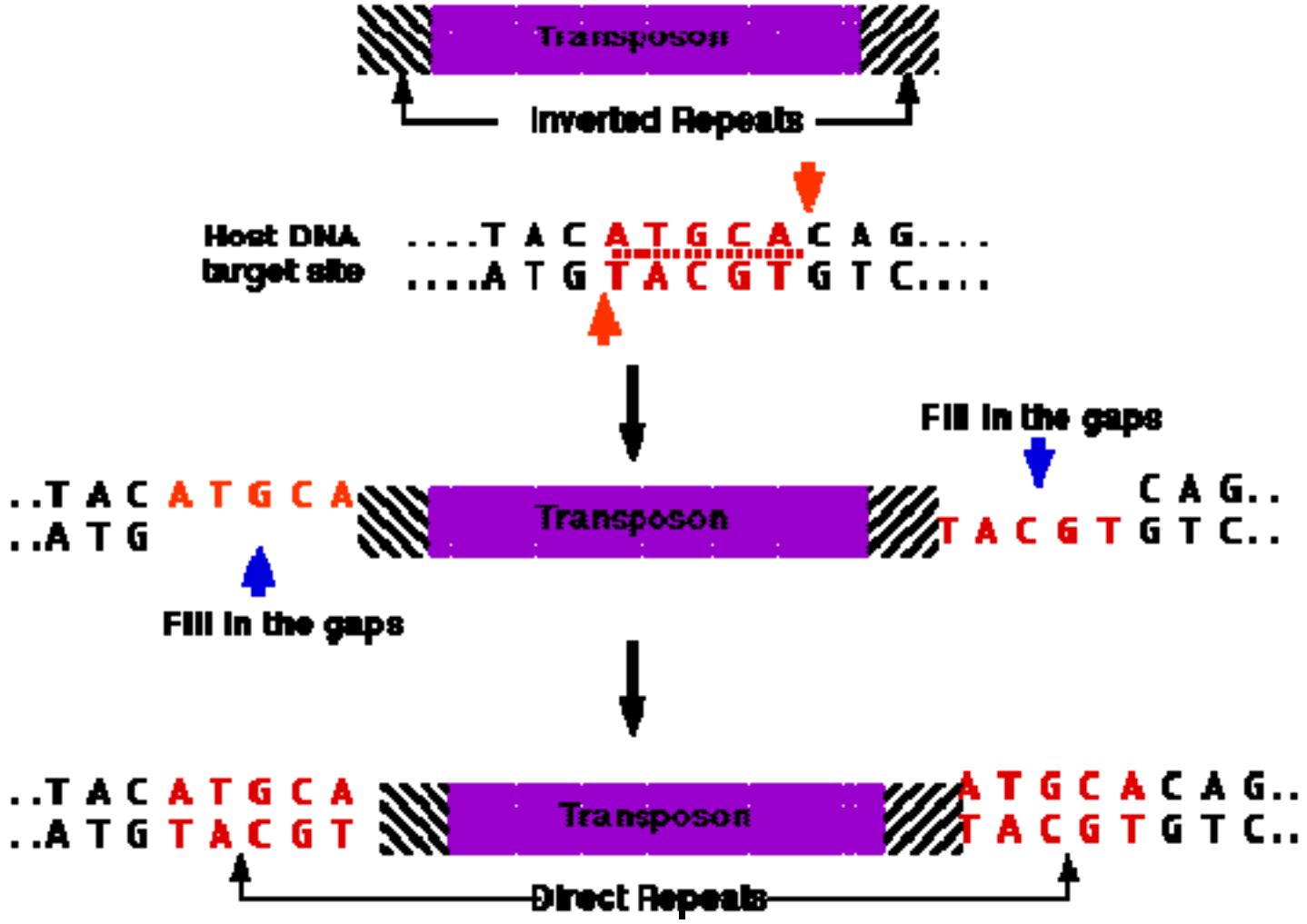
DNA-Transposons

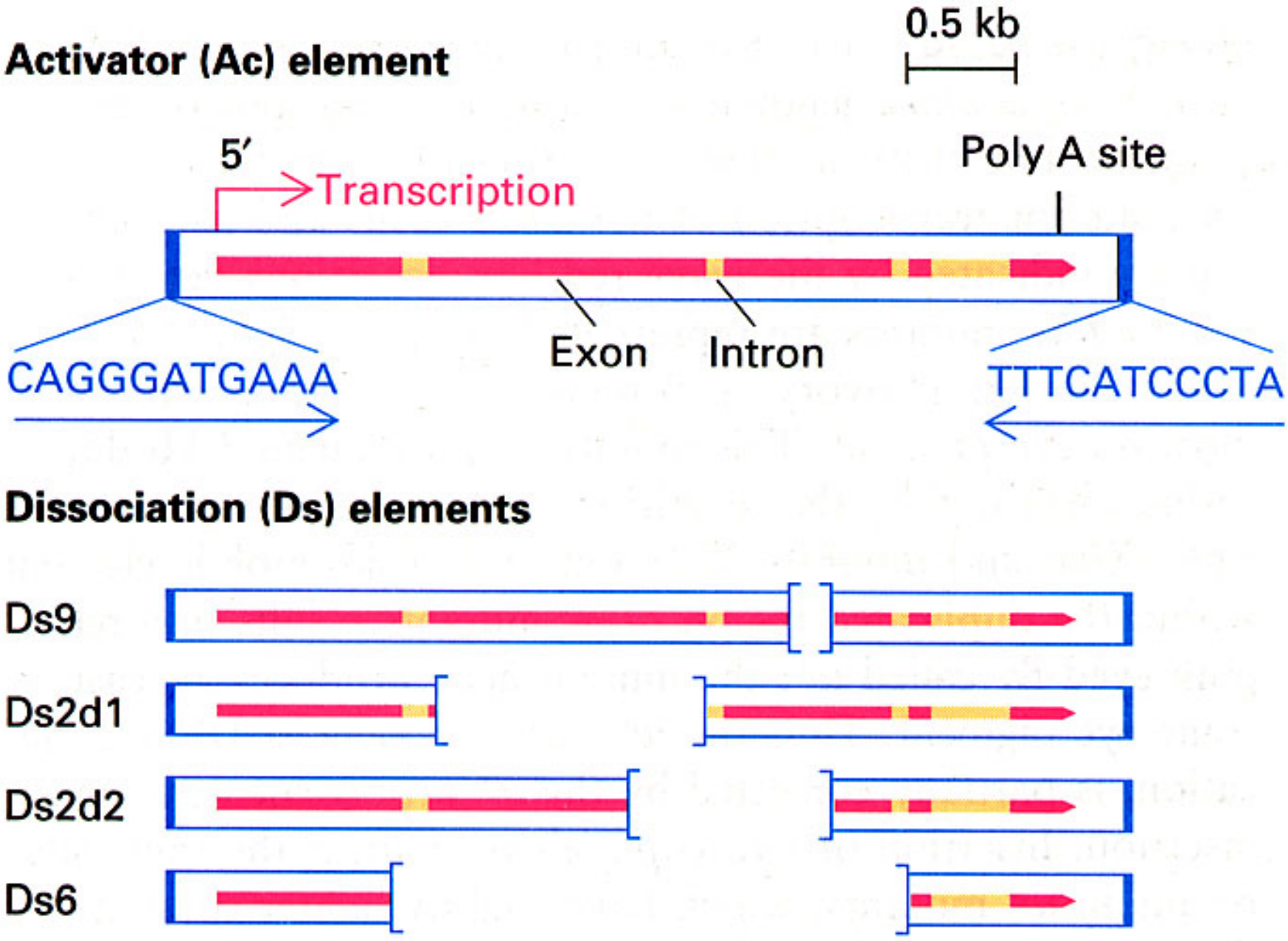


Nobel-Preis 1983

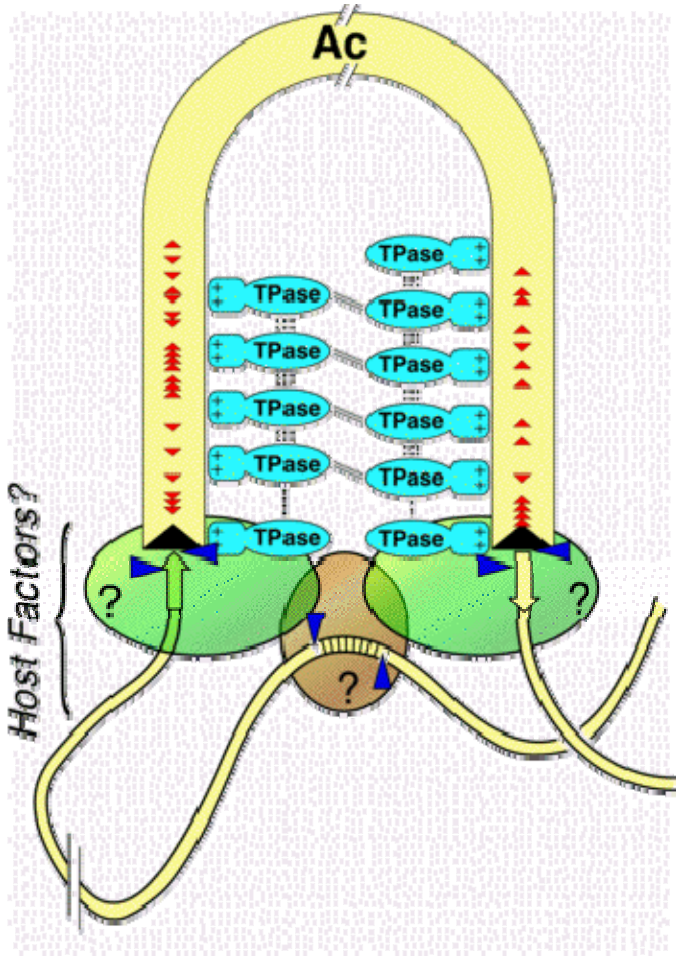
DNA-Transposons erzeugen „target site duplications“



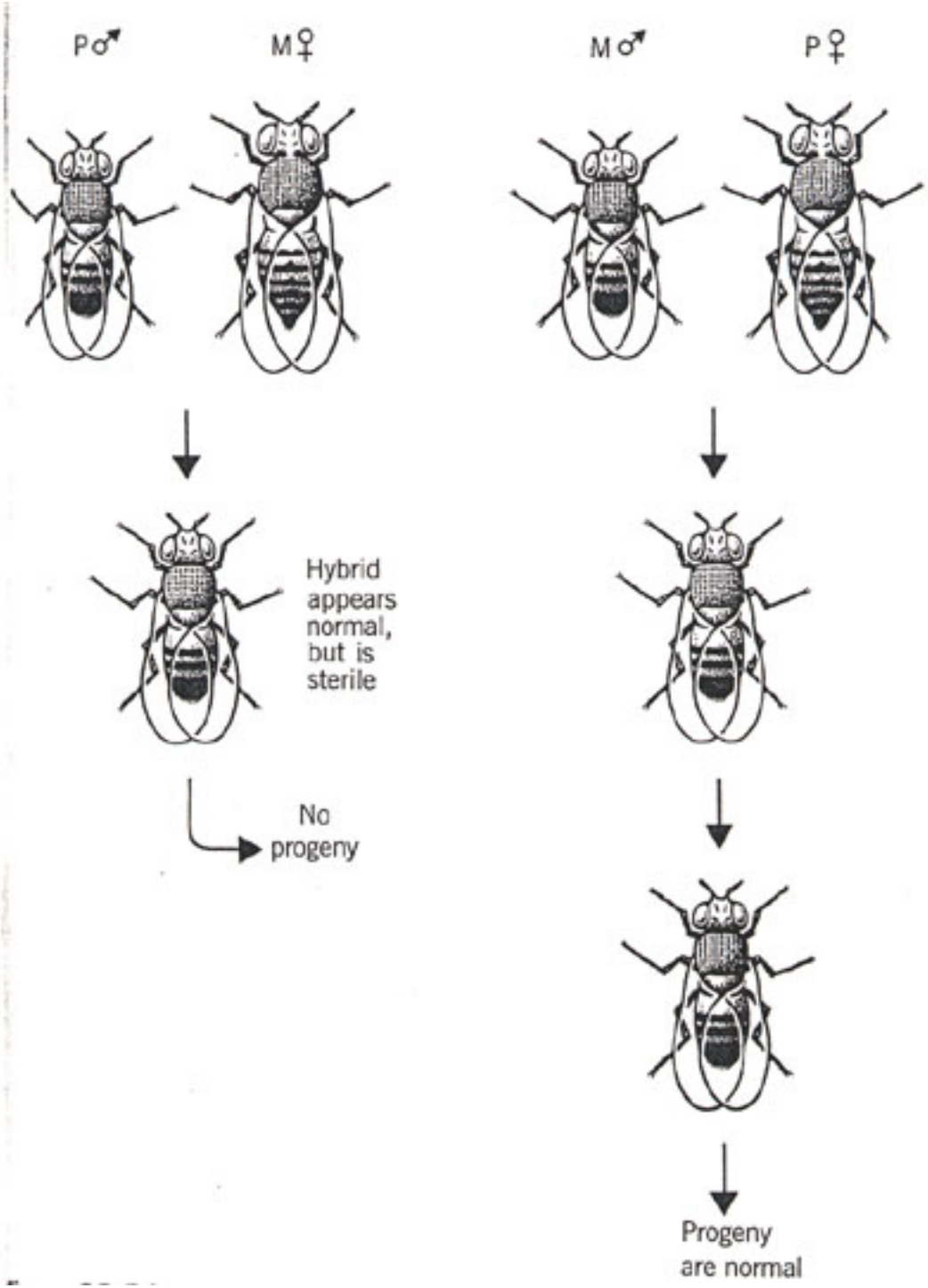
Das AC-Element besitzt eine aktive Transpsosase, Ds Elemente sind „nicht-autonom“



Bei der Transposition spielen die „inverted repeats“ ein große Rolle



Die P-Elemente von Drosophila erzeugen „hybrid dysgenesis“



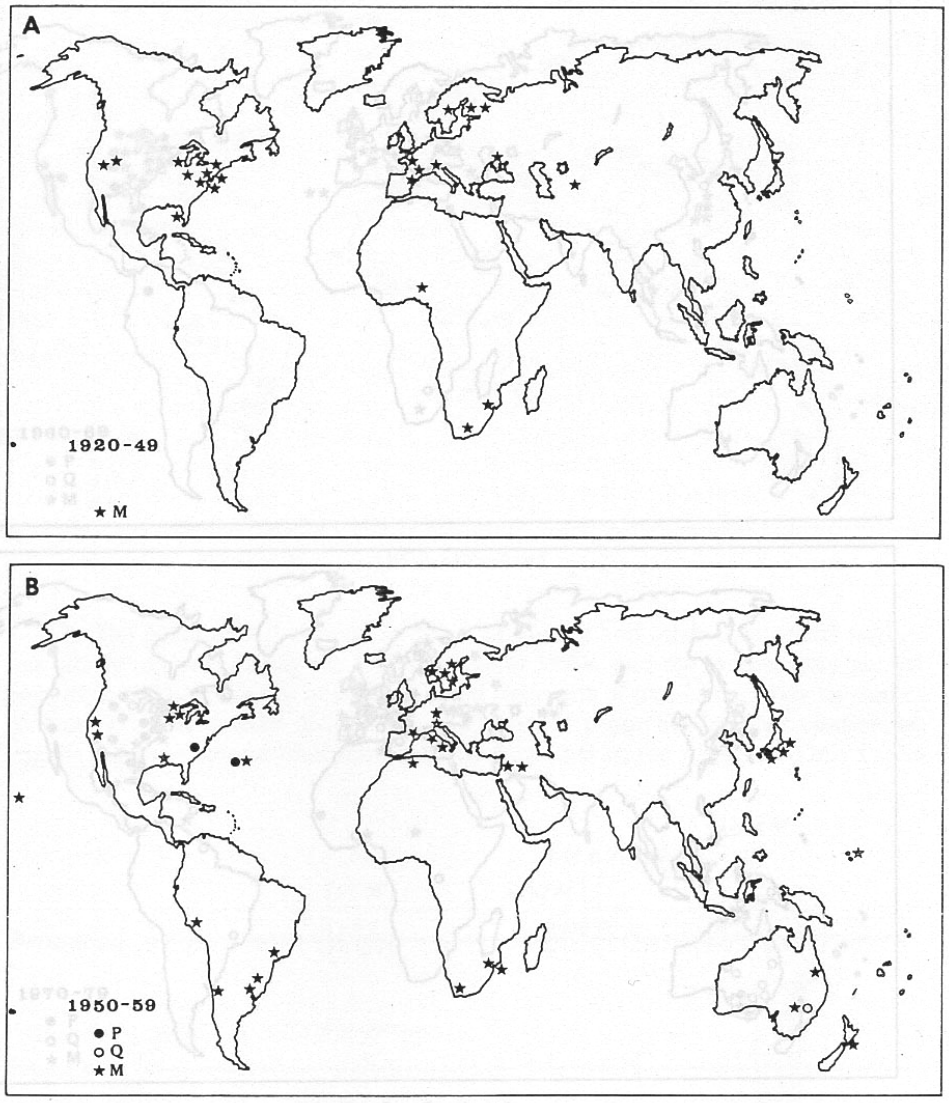


FIG. 3.—The geographical distribution of strains collected from the wild during five time periods and classified according to their cross A* phenotypic characteristics in the P-M system of hybrid dysgenesis. A, 1920–49; B, 1950–59; C, 1960–69; D, 1970–79; E, 1980–86. Strains and isofemale lines collected at the same location and having the same characteristics are represented by a single symbol.

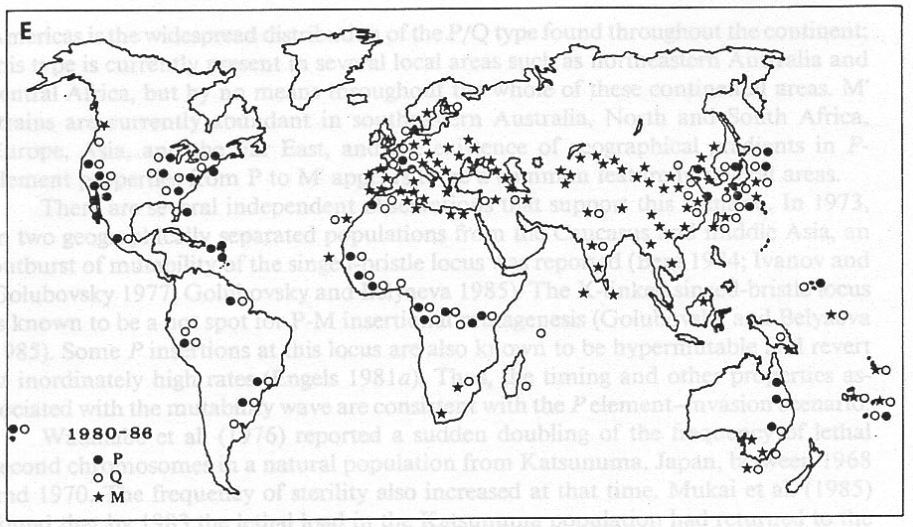
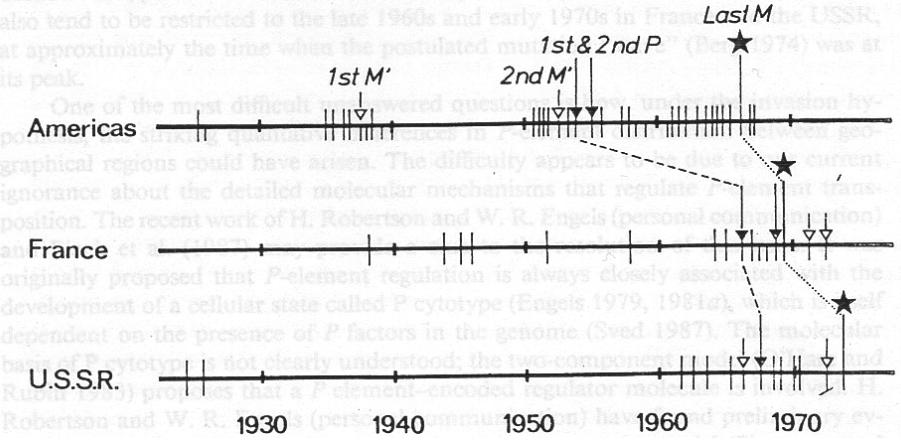
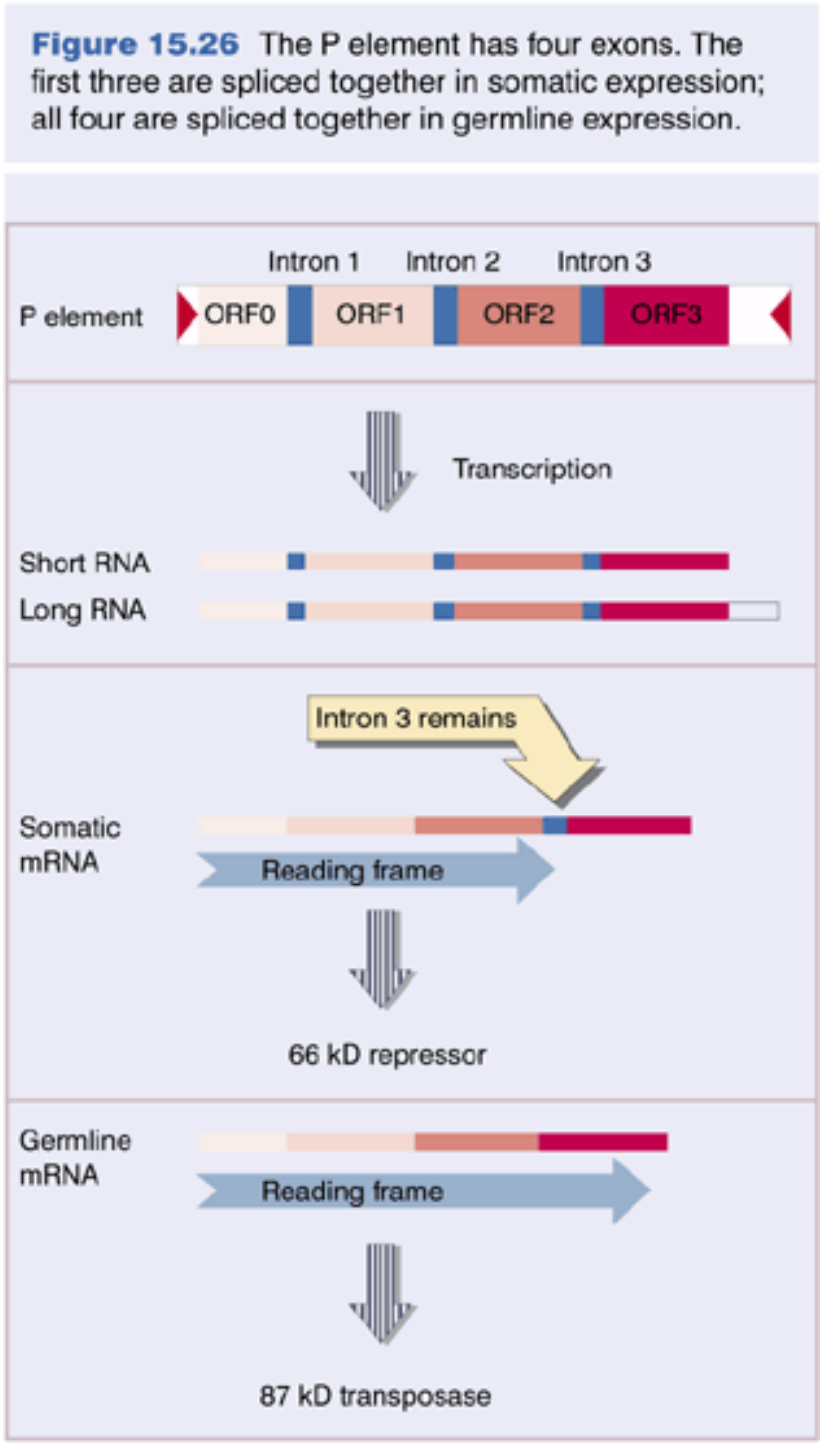


FIG. 3.—Continued.

3. The postulated *P*-element invasion of Europe and other continental regions was largely initiated during the 1960s and early 1970s, and the process may not yet be complete. The existence of isolated island reservoirs of true M populations cannot be excluded. The current distribution of *P*-element properties in other continental regions differs in several important respects from that in the Americas. Only in the



Die P-Elemente von Drosophila:



Die P-Elemente von Drosophila:

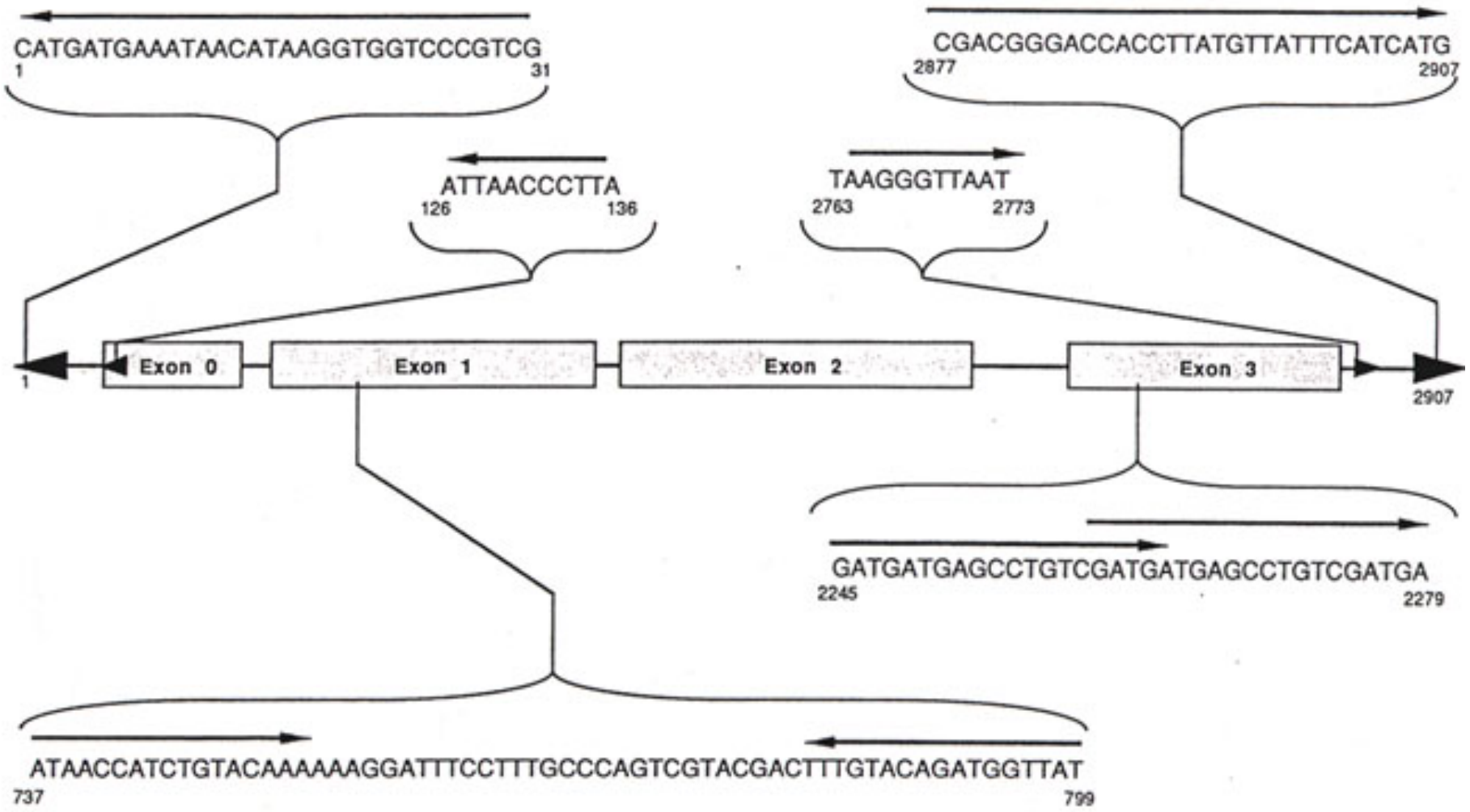
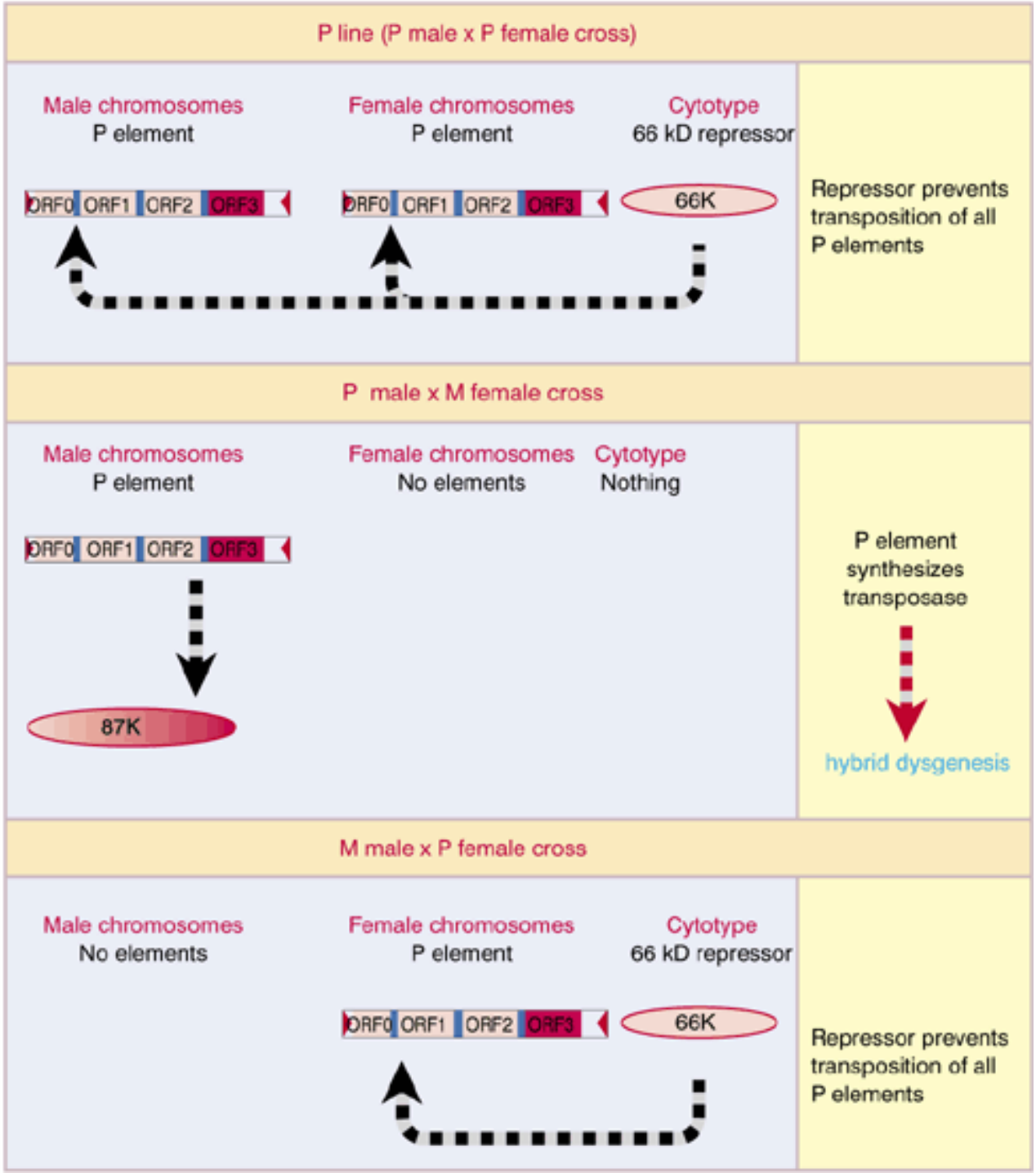


Figure 3. The complete P element and its repeat structures. The sequence was obtained by O'Hare and Rubin (155).

Figure 15.27 Hybrid dysgenesis is determined by the interactions between P elements in the genome and 66 kD repressor in the cytotype.



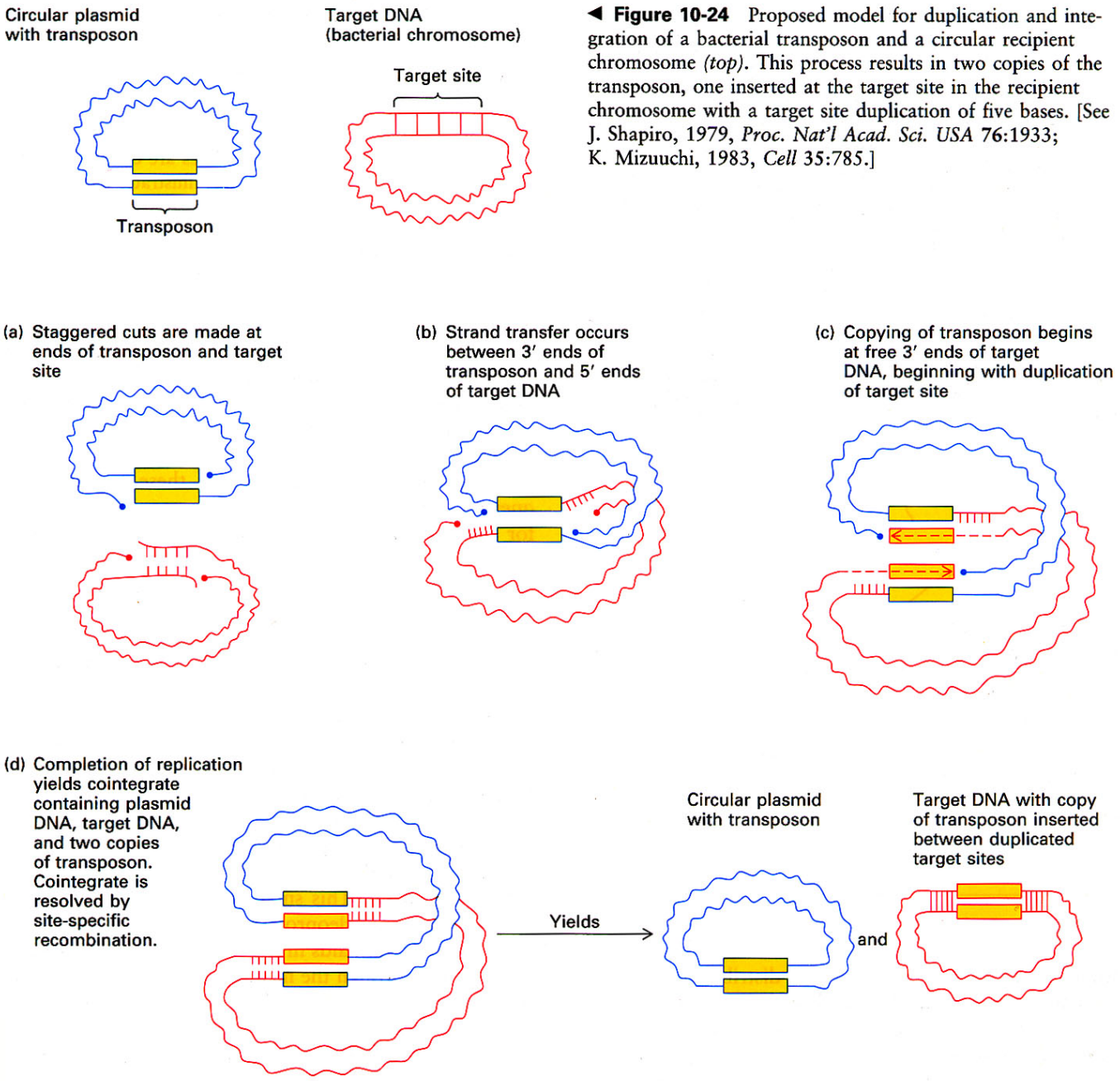
Die
„hybrid dysgenesis“
Ist die Folge von einem
Wechselspiel von
aktiver Transposase
In Keimzellen von P-freien
Tieren und dem Repressor
In P-haltigen Tieren

DNA-Transposons beim Menschen

Table 11 Number of copies and fraction of genome for classes of interspersed repeat

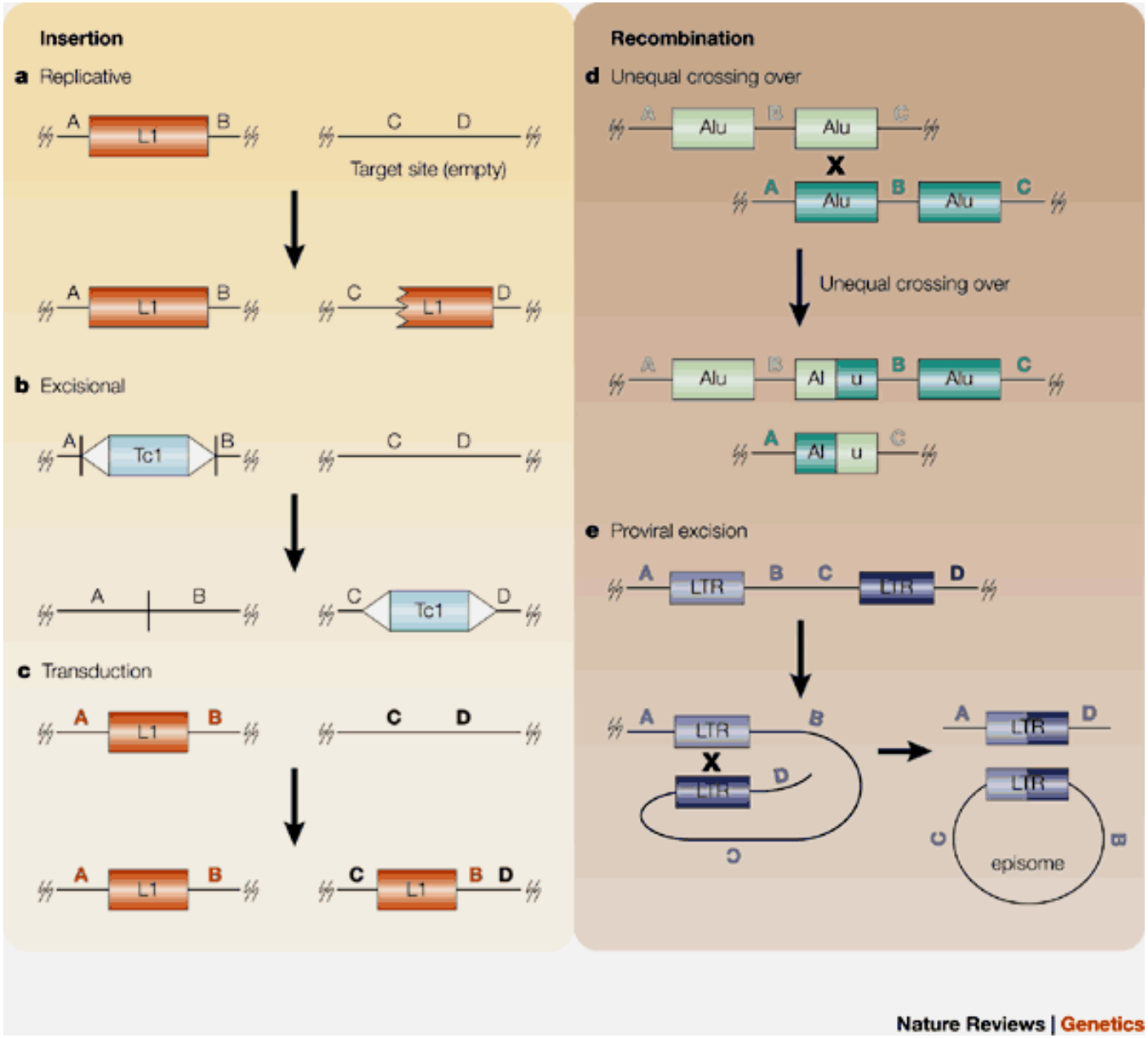
	Number of copies (× 1,000)	Total number of bases in the draft genome	Fraction of the draft genome sequence (%)	Number of families (subfamilies)
DNA elements	294	77.6	2.84	
hAT group				
MER1-Charlie	182	38.1	1.39	25 (50)
Zaphod	13	4.3	0.16	4 (10)
Tc-1 group				
MER2-Tigger	57	28.0	1.02	12 (28)
Tc2	4	0.9	0.03	1 (5)
Mariner	14	2.6	0.10	4 (5)
PiggyBac-like	2	0.5	0.02	10 (20)
Unclassified	22	3.2	0.12	7 (7)

Mechanismus der replikativen Transpososition

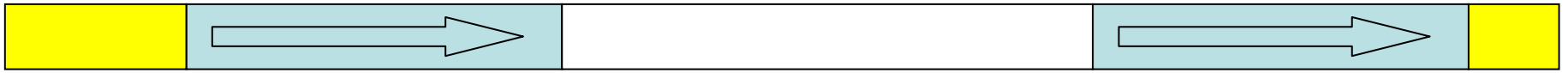


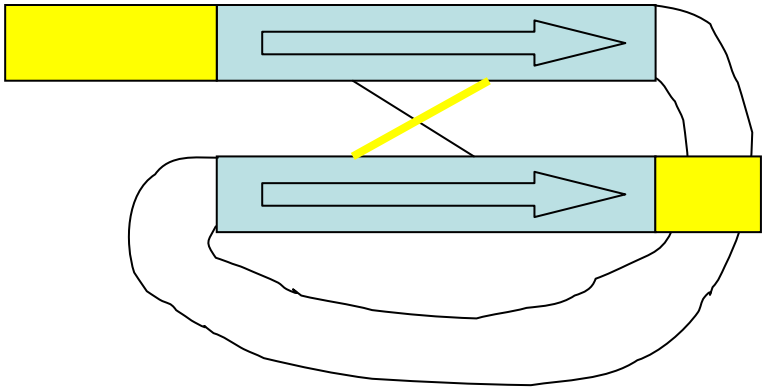
◀ **Figure 10-24** Proposed model for duplication and integration of a bacterial transposon and a circular recipient chromosome *(top)*. This process results in two copies of the transposon, one inserted at the target site in the recipient chromosome with a target site duplication of five bases. [See J. Shapiro, 1979, *Proc. Nat'l Acad. Sci. USA* 76:1933; K. Mizuuchi, 1983, *Cell* 35:785.]

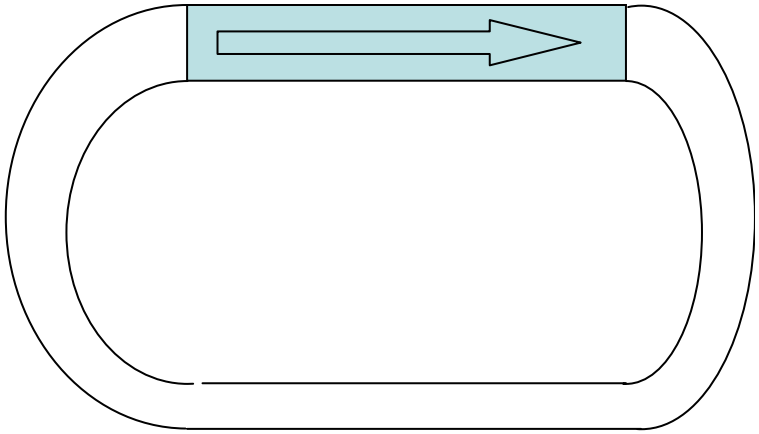
Vermehrung und Transposition von repetitiven Elementen



Interspergierte repetitive Elemente können Inversionen und Deletionen erzeugen

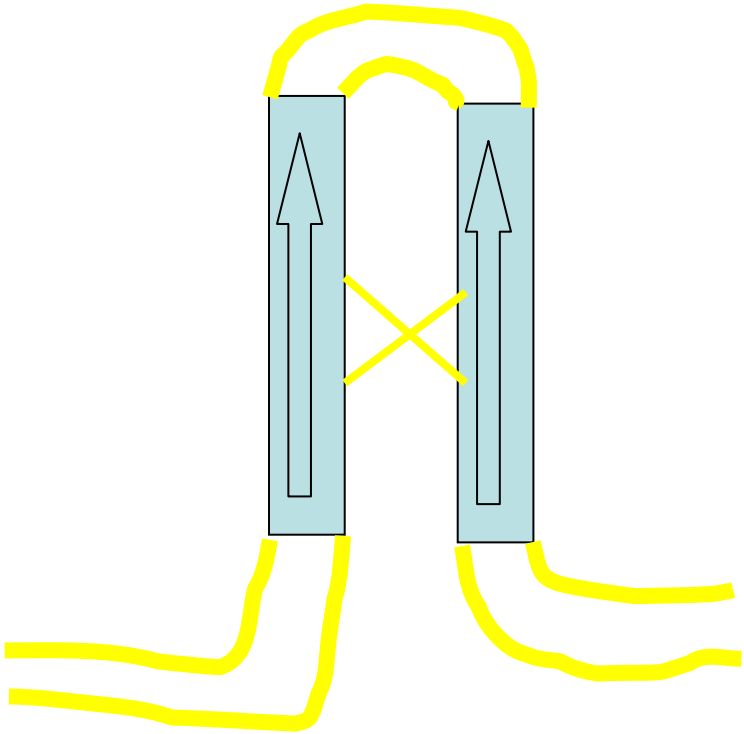




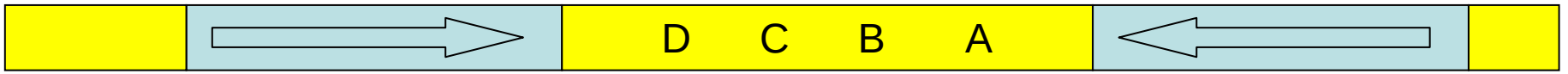


Ergebnis:

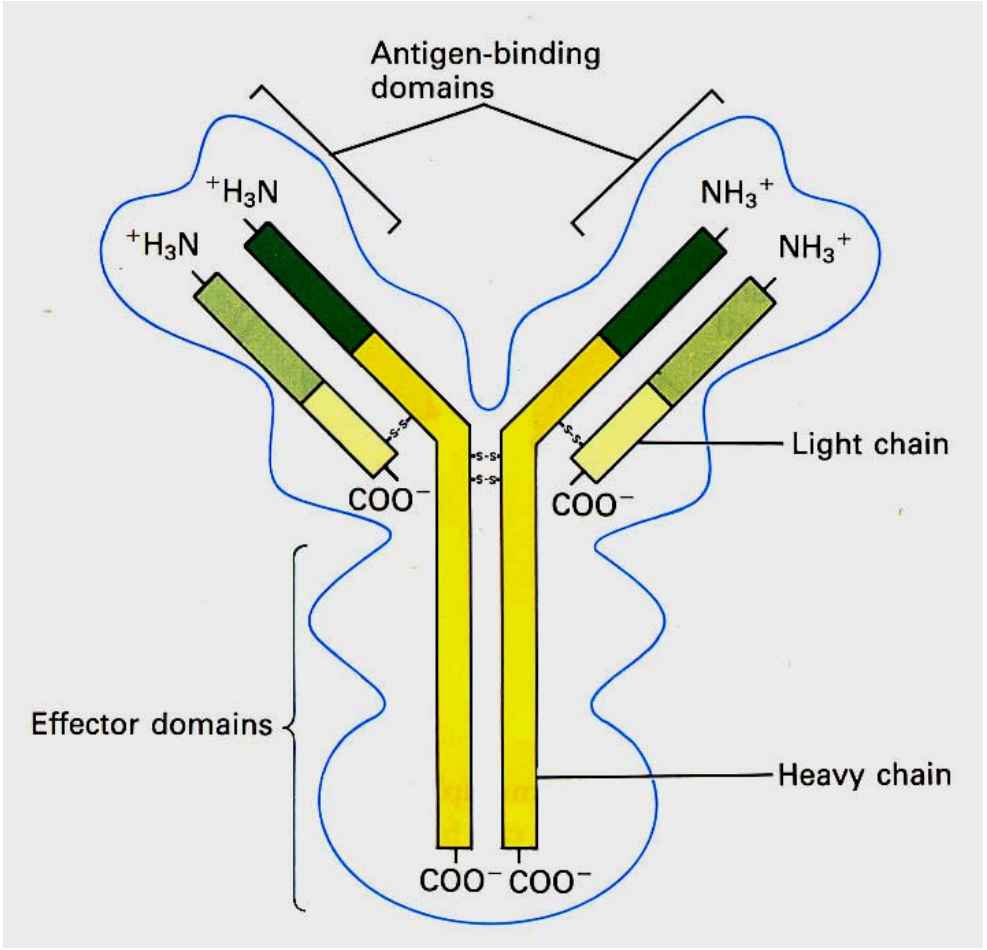
Interspergierte repetitive Elemente können Inversionen und Deletionen erzeugen



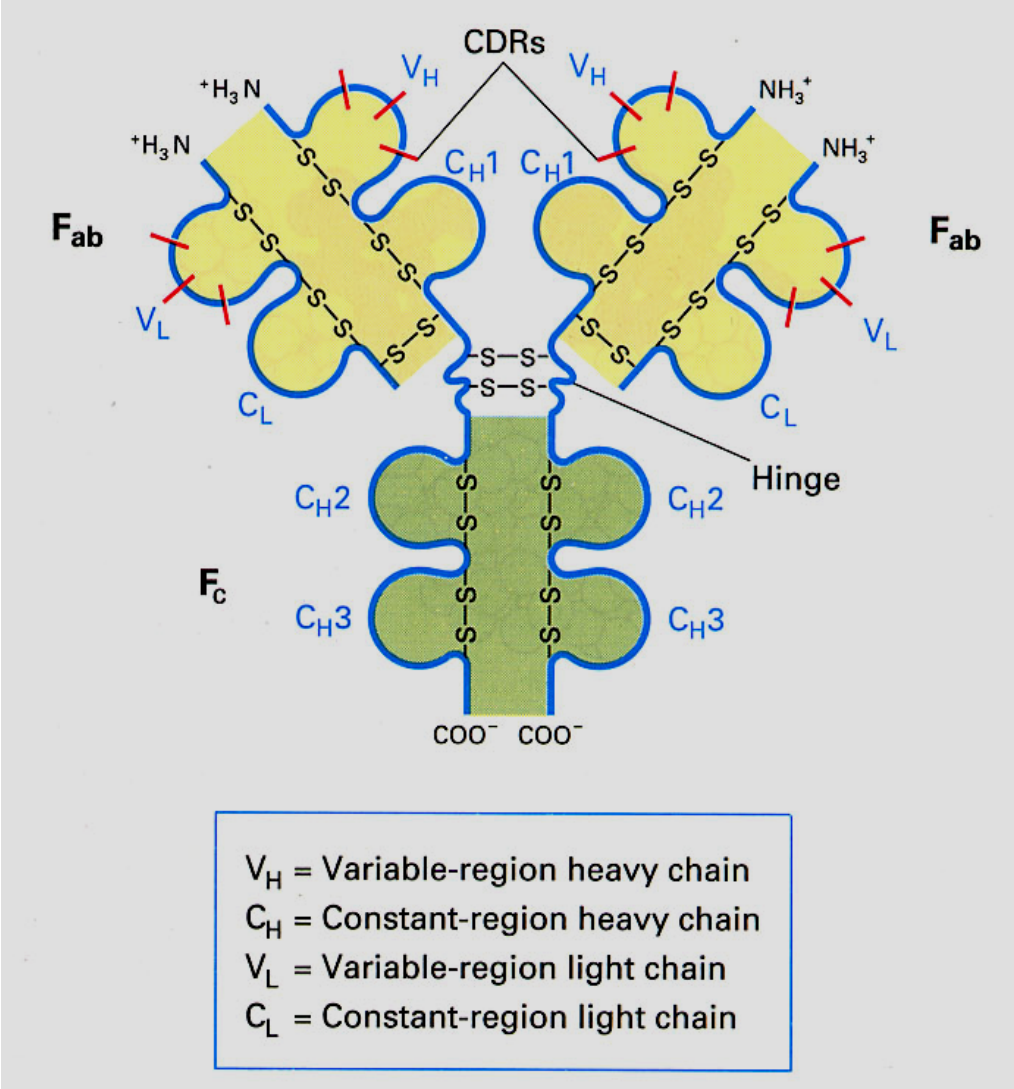
Ergebnis:



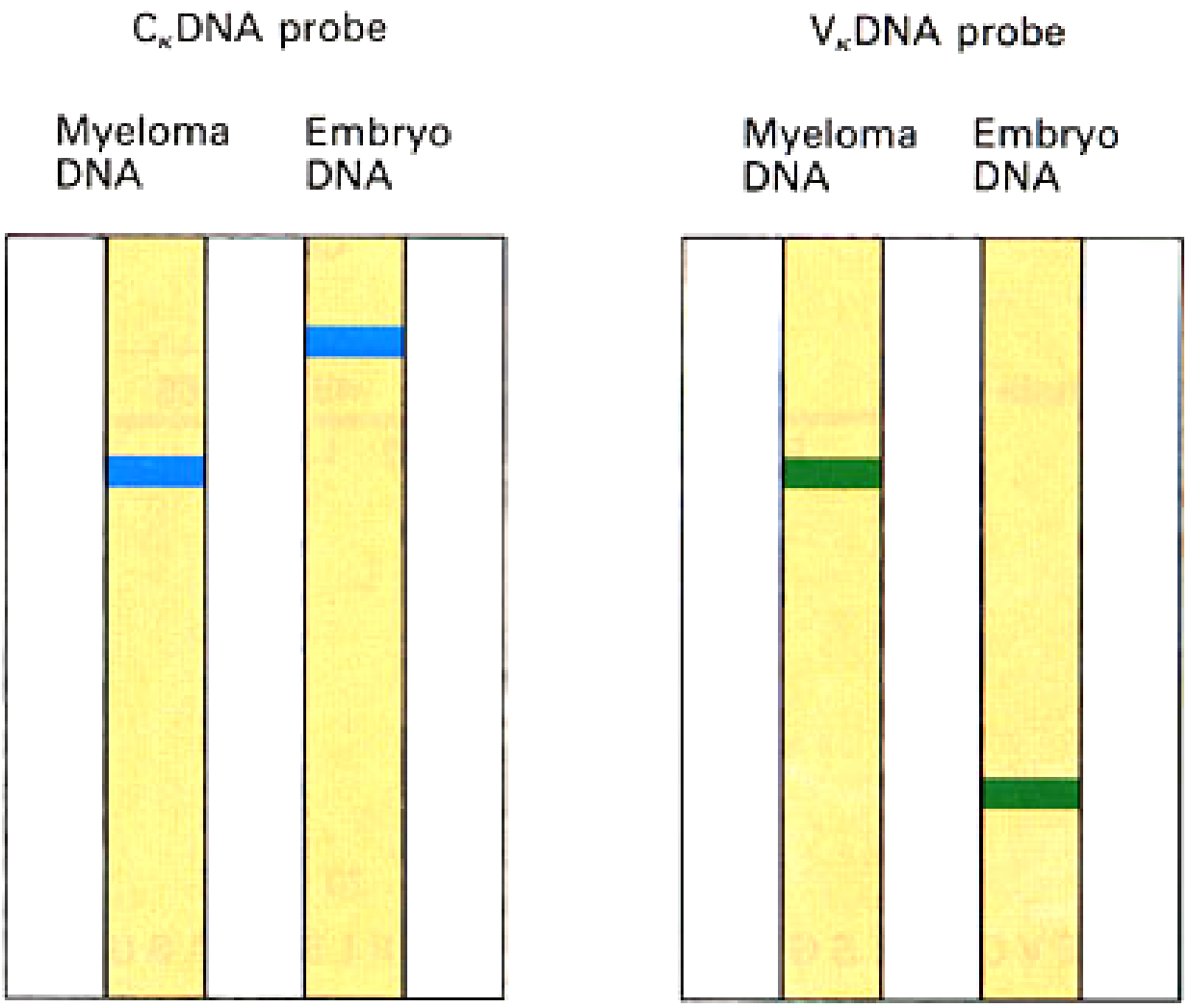
Die Variabilität der Immunglobuline:



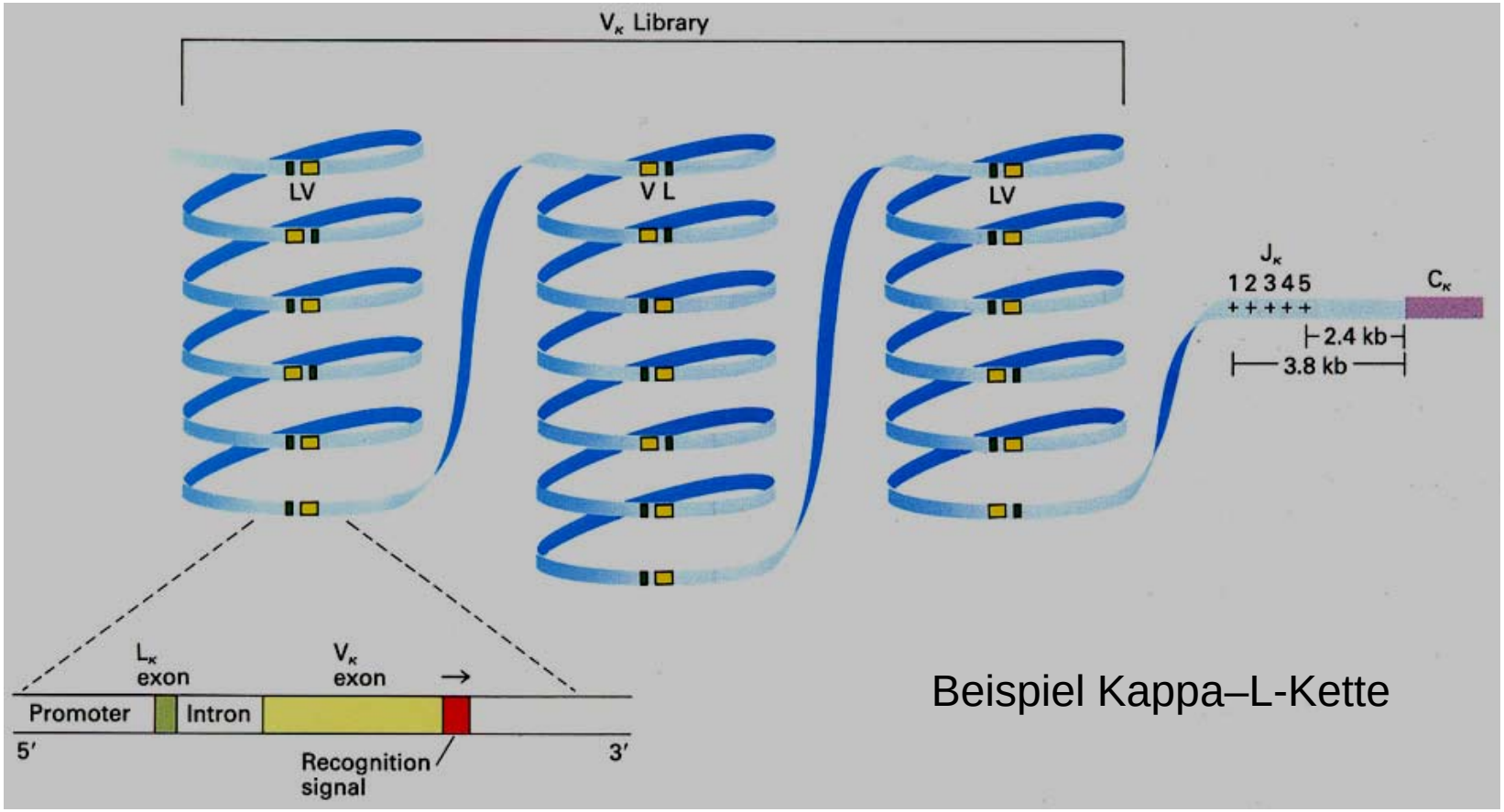
Die Immunglobuline bestehen aus zwei Ketten, L und H, die über Disulfidbrücken verknüpft sind



Die Variabilität der Antikörper wird durch „Rearrangements“ der Genteile während der Immunzellenreifung erzeugt: die Southern-Analyse zeigt Unterschiede zwischen Embryo und „reifen“ Immunzellen

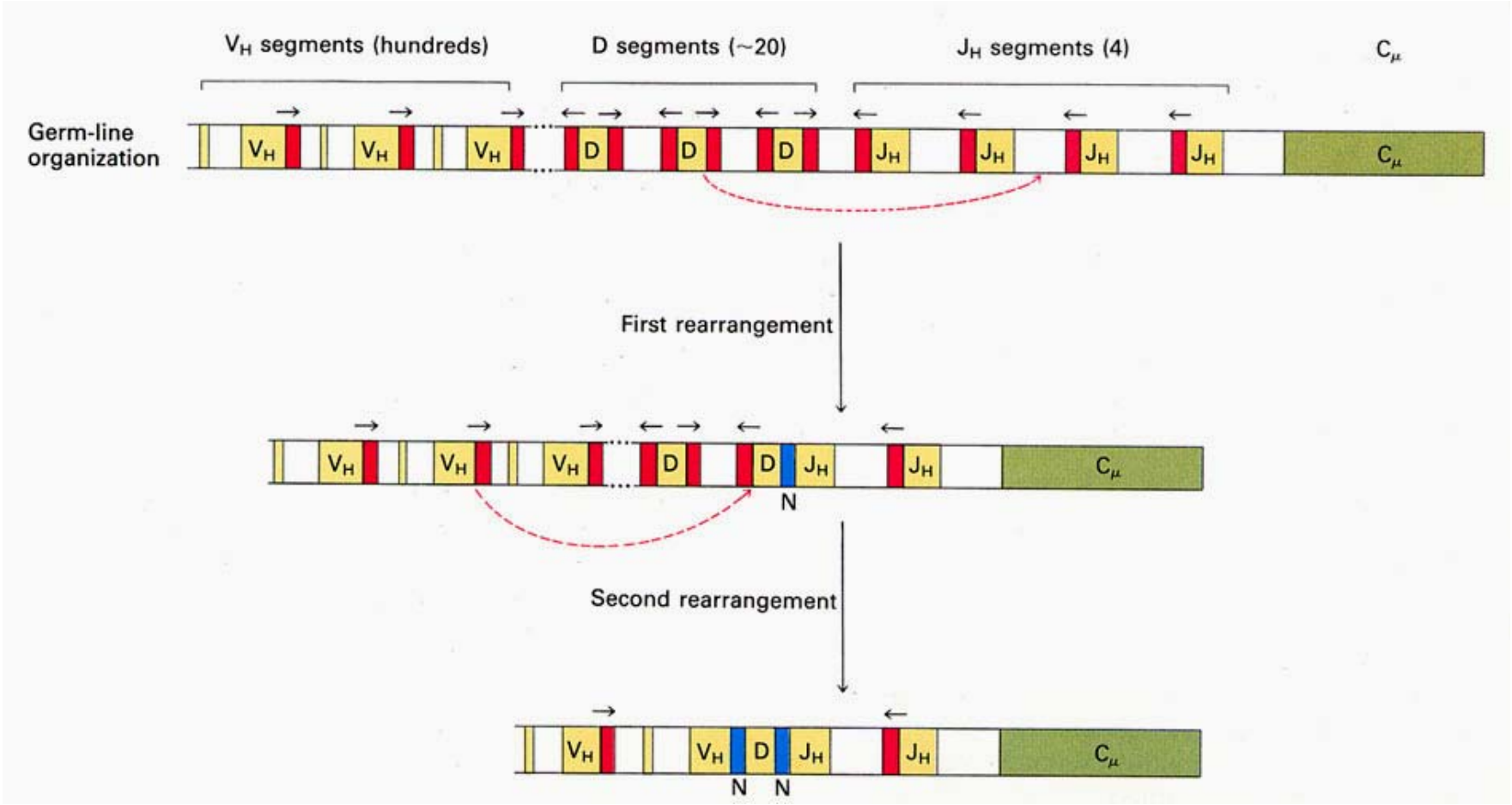


Die Gene für Immunglobuline bestehen aus verschiedenen Teilen, die in den Chromosomen nicht unmittelbar zusammen liegen

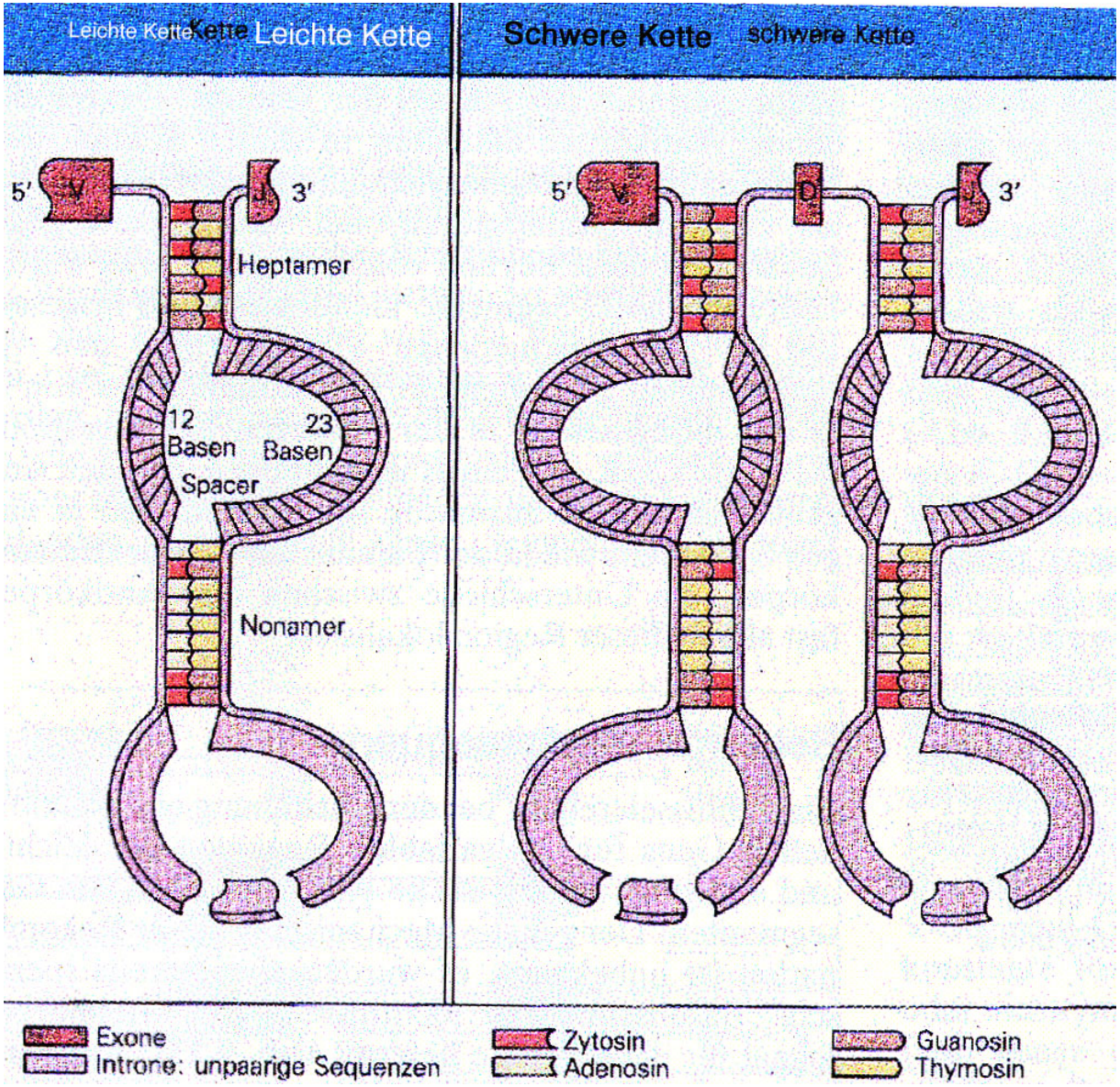


Beispiel Kappa–L-Kette

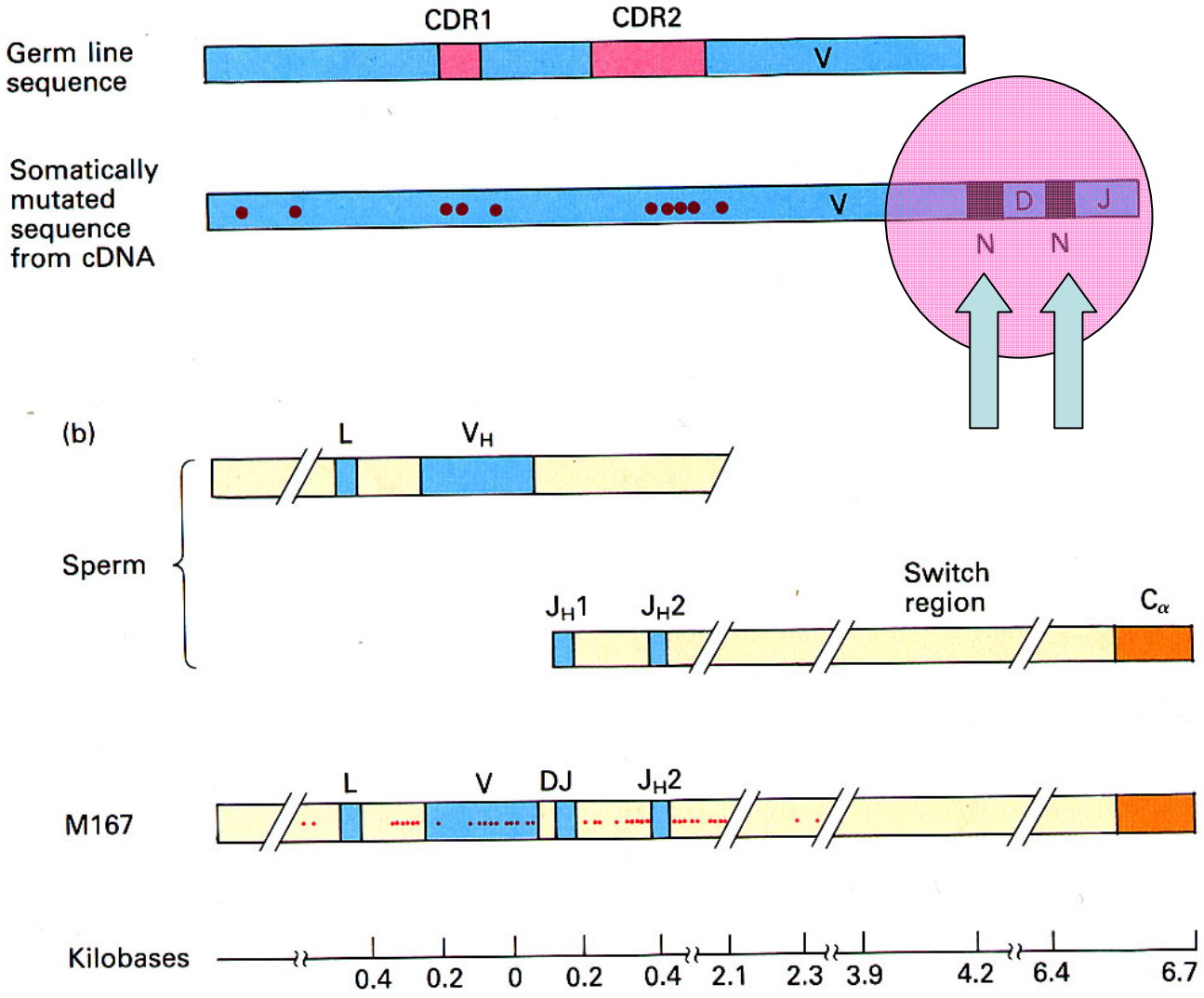
Beim „Rearrangement“ werden jeweils einzelne der Genteile „rekombiniert“



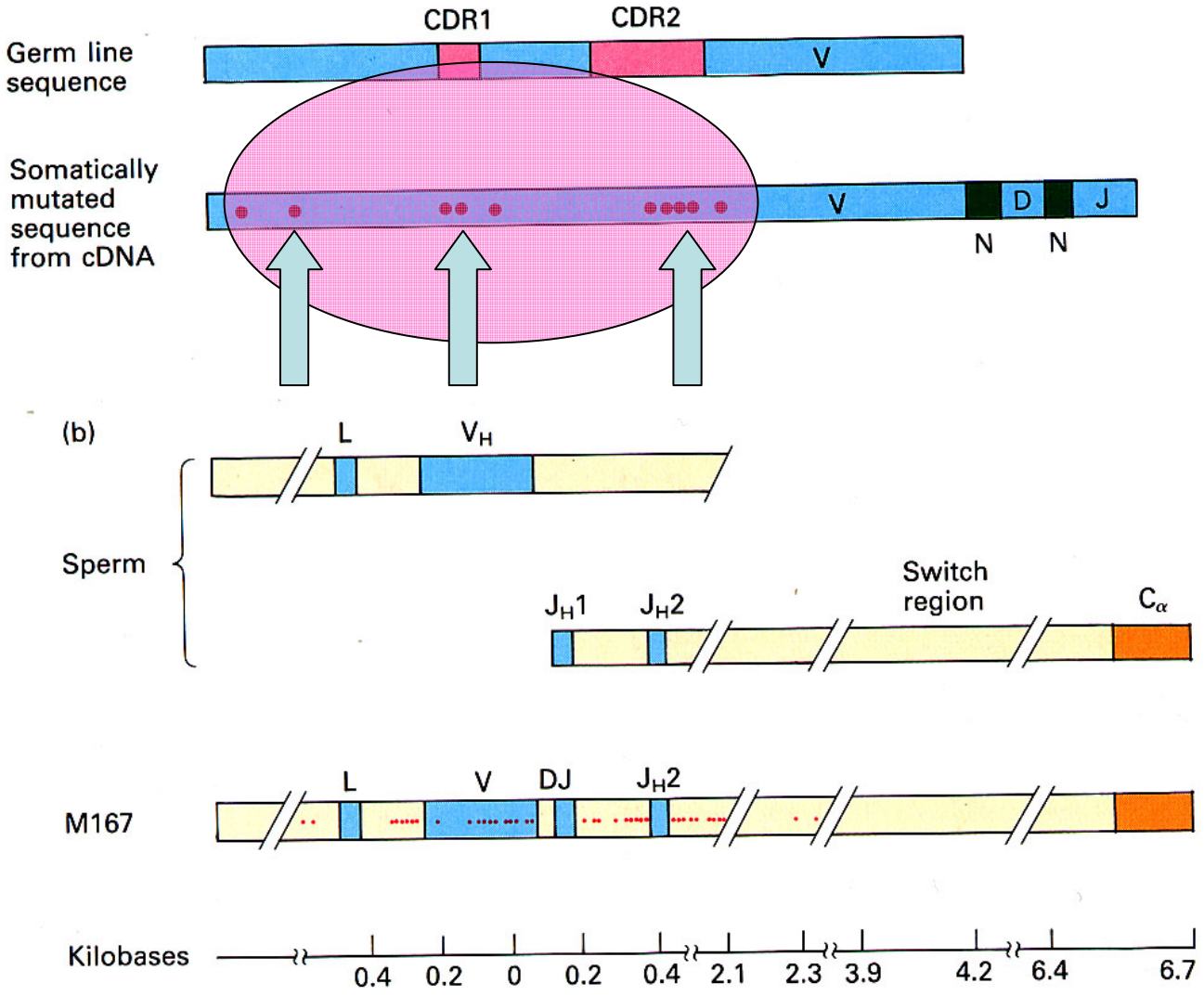
Die Rekombination wird vermittelt durch die „Rekombinationssequenz“ am Ende der Genteile



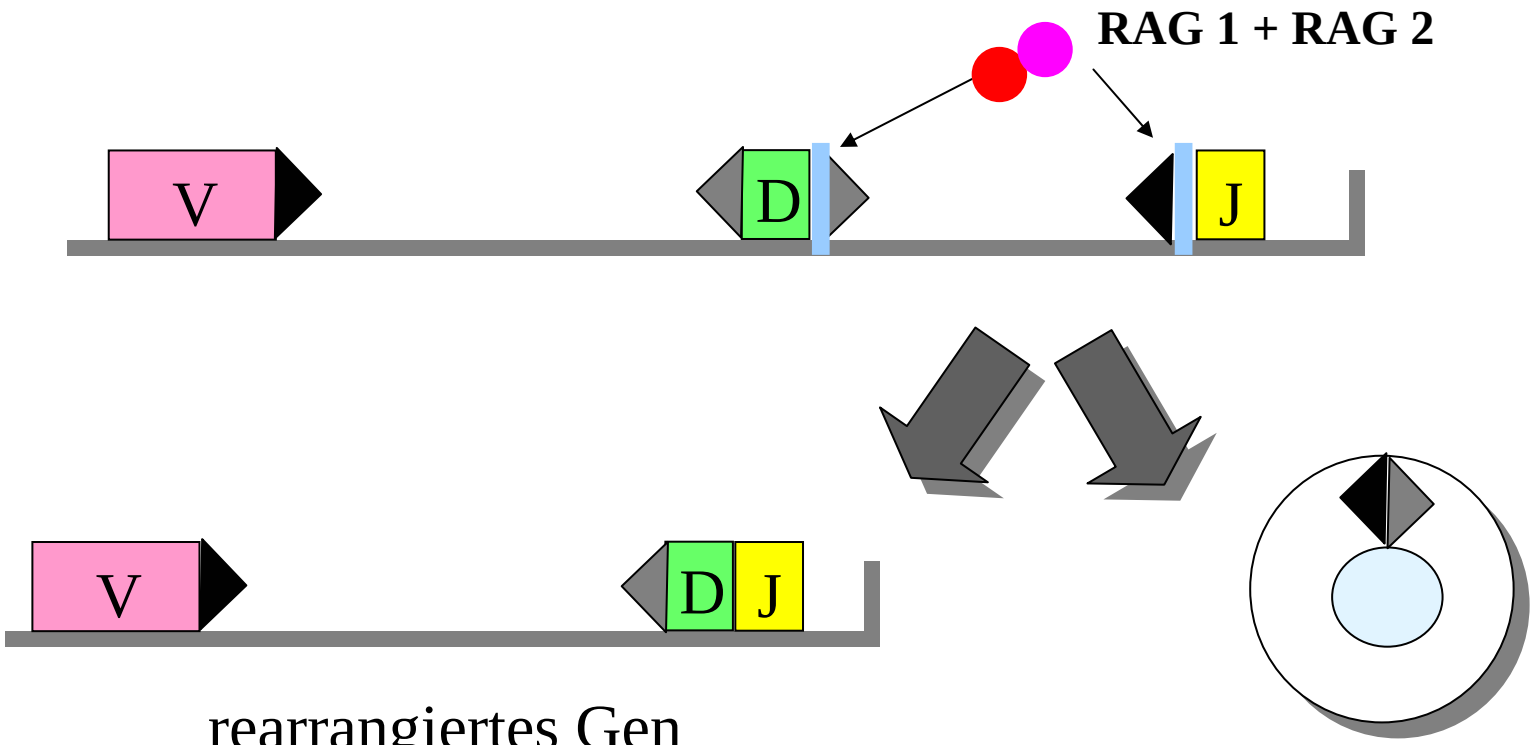
Bei der VDJ- Rekombination werden noch zusätzlich Nukleotide von der terminalen Nukleotidyltransferase Basen eingefügt,



Bei der VDJ- Rekombination entstehen außerdem „somatische Mutationen“



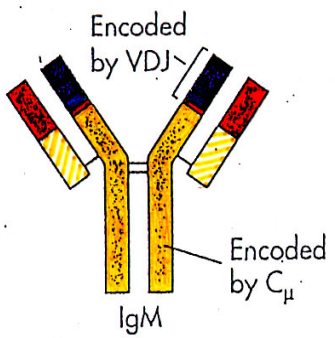
Molekulares Geschehen bei der V-D-J-Rekombination /

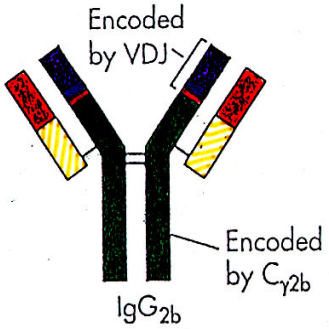


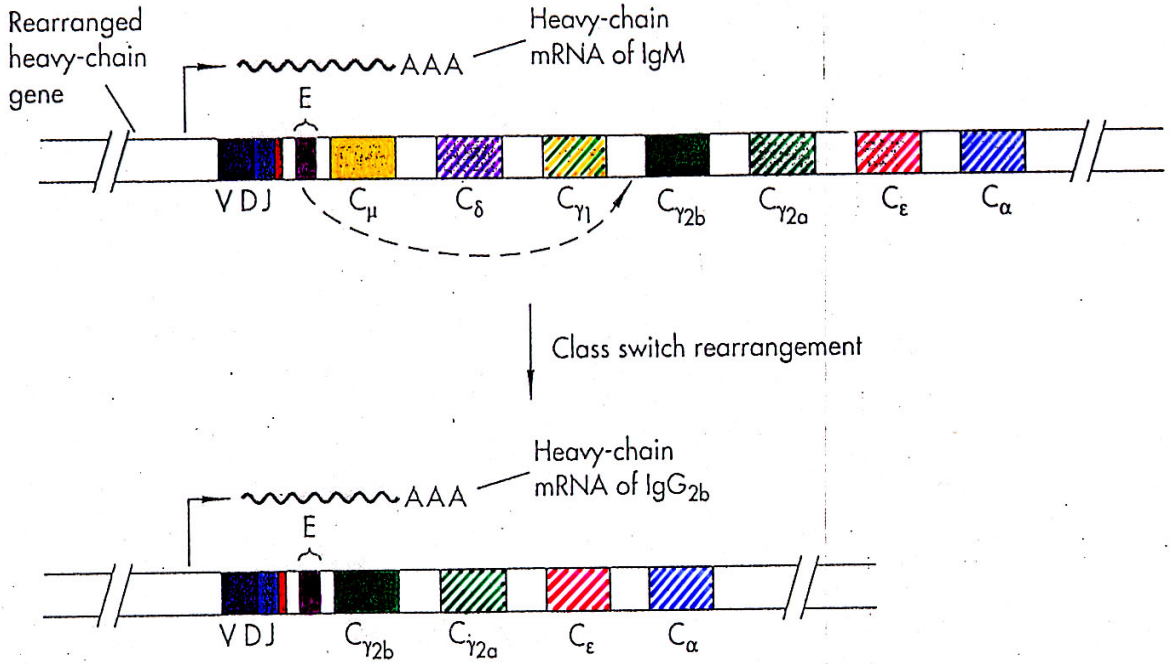
rearrangiertes Gen

extrachromosomale, zirkuläre DNA

Es gibt zusätzlich verschiedene Antikörperklassen. Die Klasse wird durch die C-Region bestimmt







18.3 Antibody Classes (Part 1)

CLASS	GENERAL STRUCTURE		LOCATION	FUNCTION
IgG	Monomer		Free in plasma; about 80 percent of circulating antibodies	Most abundant antibody in primary and secondary responses; crosses placenta and provides passive immunization to fetus
IgM	Pentamer		Surface of B cell; free in plasma	Antigen receptor on B cell membrane; first class of antibodies released by B cells during primary response
IgD	Monomer		Surface of B cell	Cell surface receptor of mature B cell; important in B cell activation

LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, Table 18.3 (Part 1)

18.3 *Antibody Classes (Part 1)*

CLASS	GENERAL STRUCTURE		LOCATION	FUNCTION
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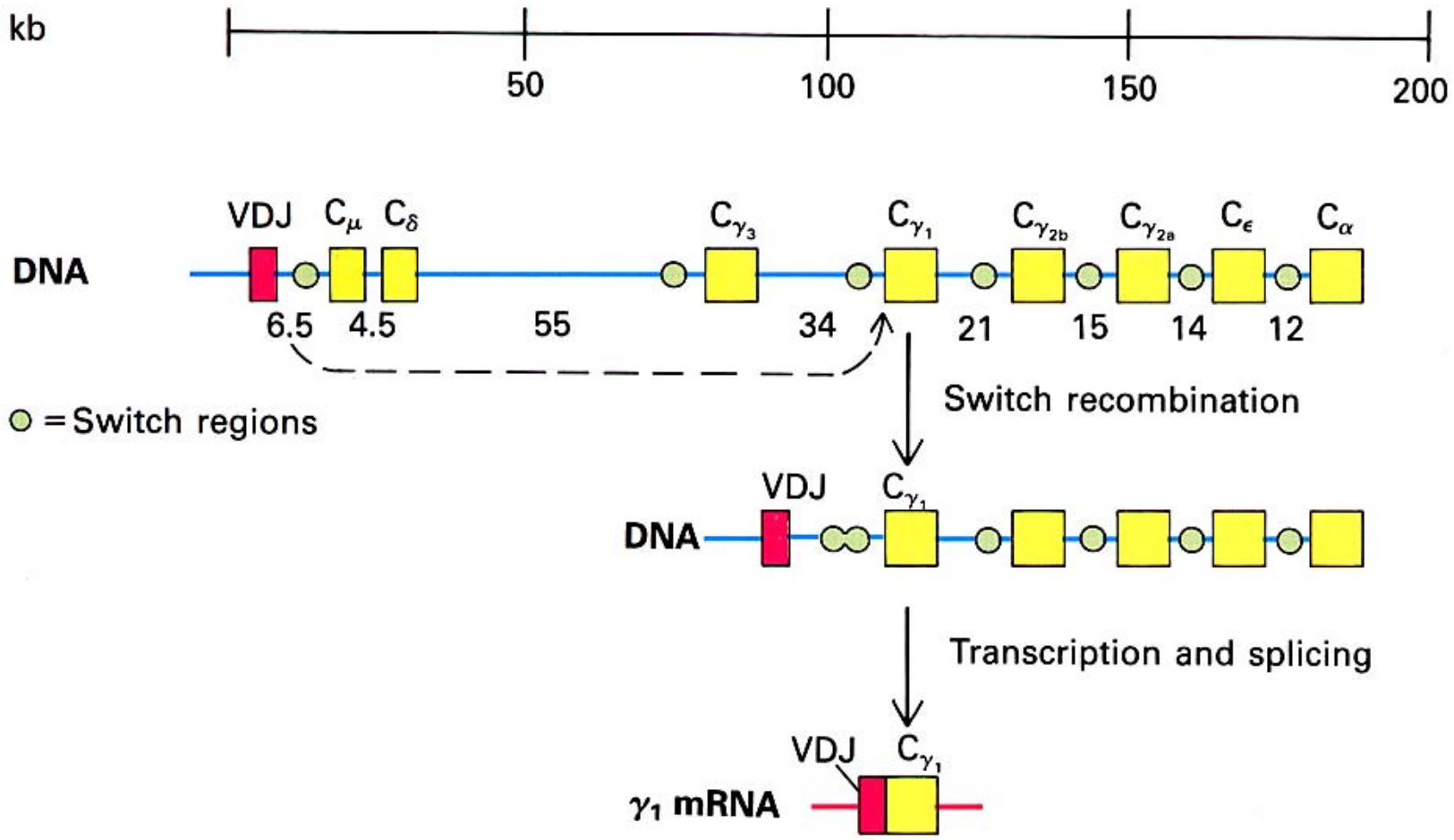
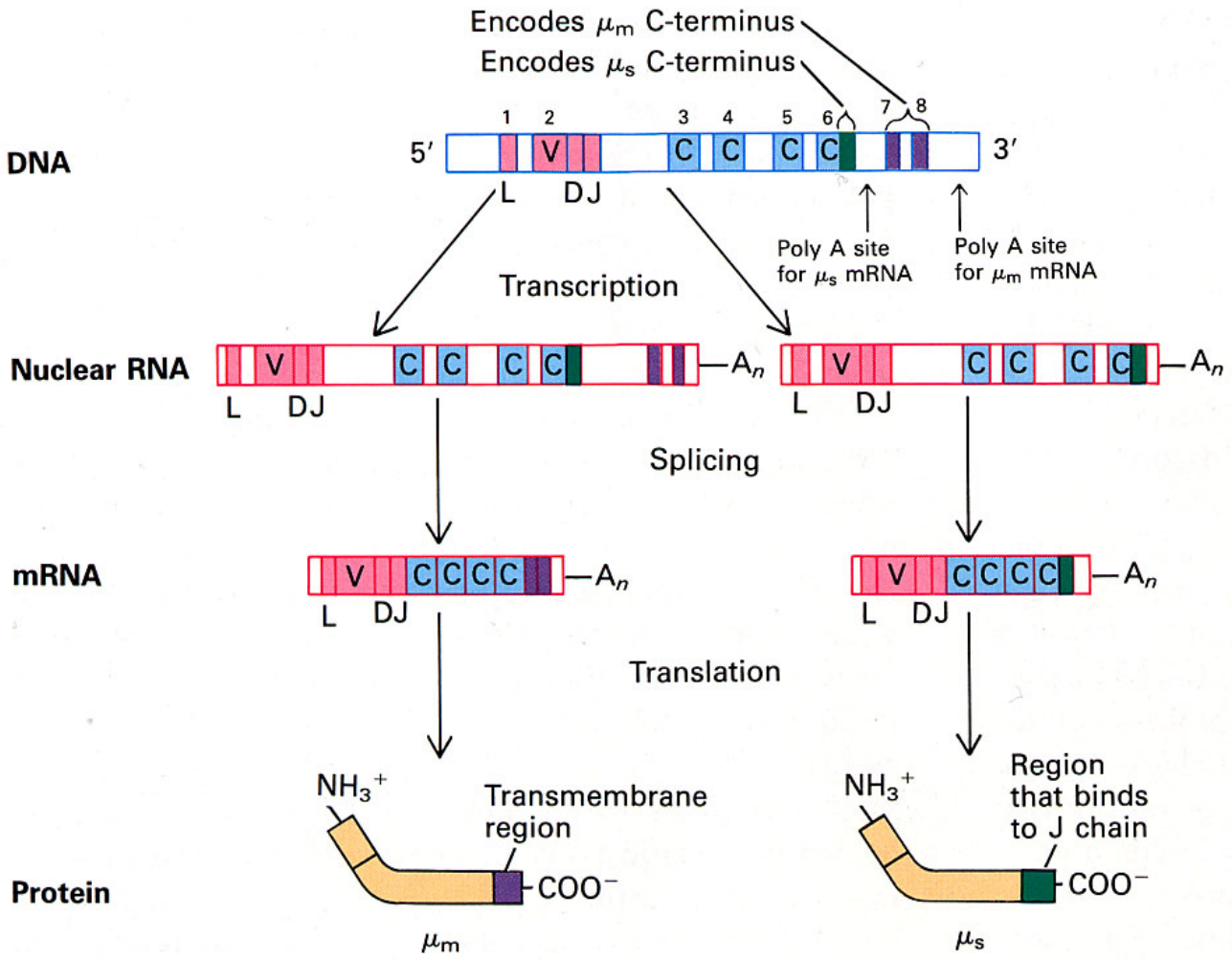
IgM	Pentamer		Surface of B cell; free in plasma	Antigen receptor on B cell membrane; first class of antibodies released by B cells during primary response
IgD	Monomer		Surface of B cell	Cell surface receptor of mature B cell; important in B cell activation
IgA	Dimer		Monomer found in plasma; polymers in saliva, tears, milk, and other body secretions	Protects mucosal surfaces; prevents attachment of pathogens to epithelial cells
IgE	Monomer		Secreted by plasma cells in skin and tissues lining gastrointestinal and respiratory tracts	Found on mast cells and basophils; when bound to antigens, triggers release of histamine from mast cell or basophil that contributes to inflammation and some allergic responses

LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, Table 18.3 (Part 1)

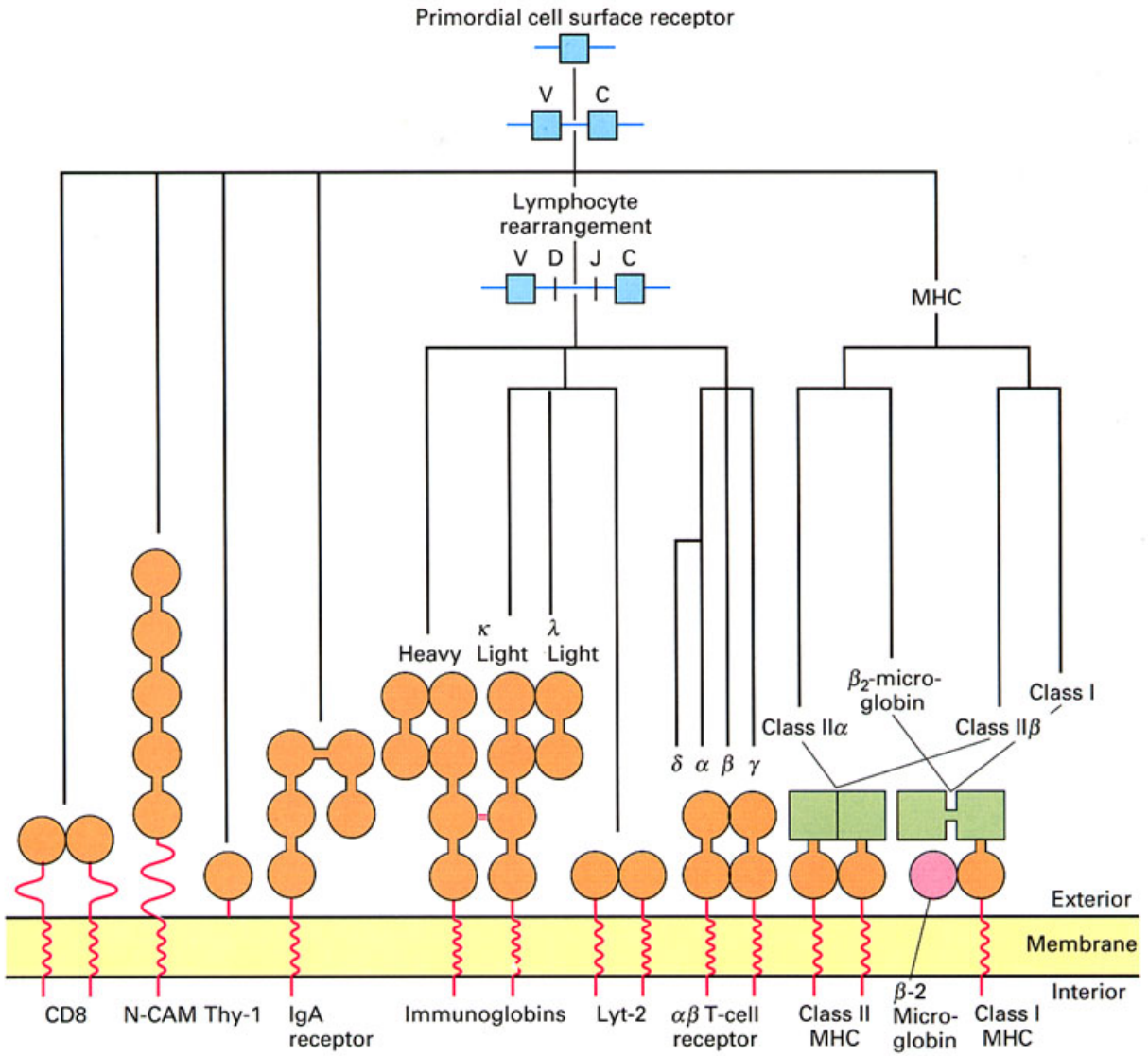
Der Antikörper “switch“ erfolgt durch Rekombination zwischen verschiedenen C-Abschnitten in der „switch“-Region



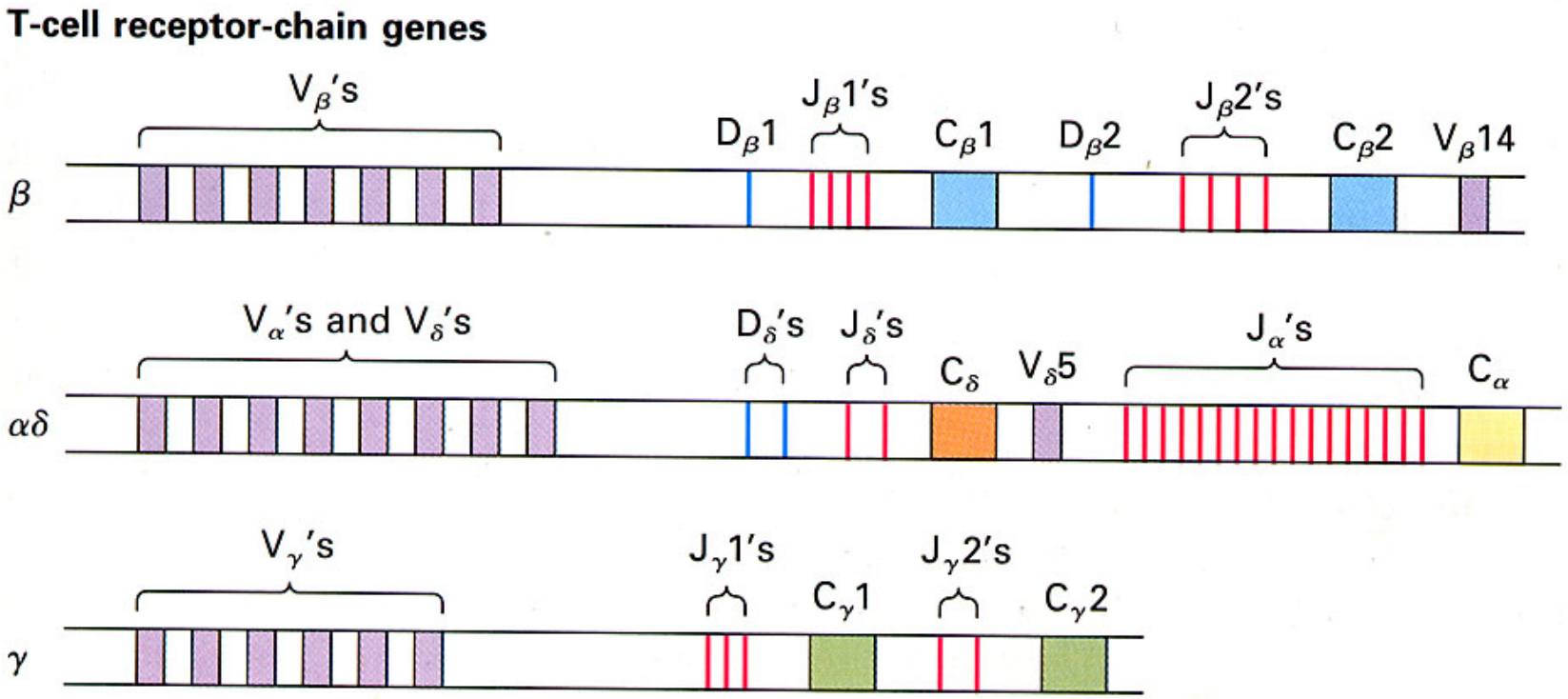
Durch Verwendung unterschiedlicher Polyadenylierungsstellen kann entweder die lösliche oder die membranständige Form erzeugt werden



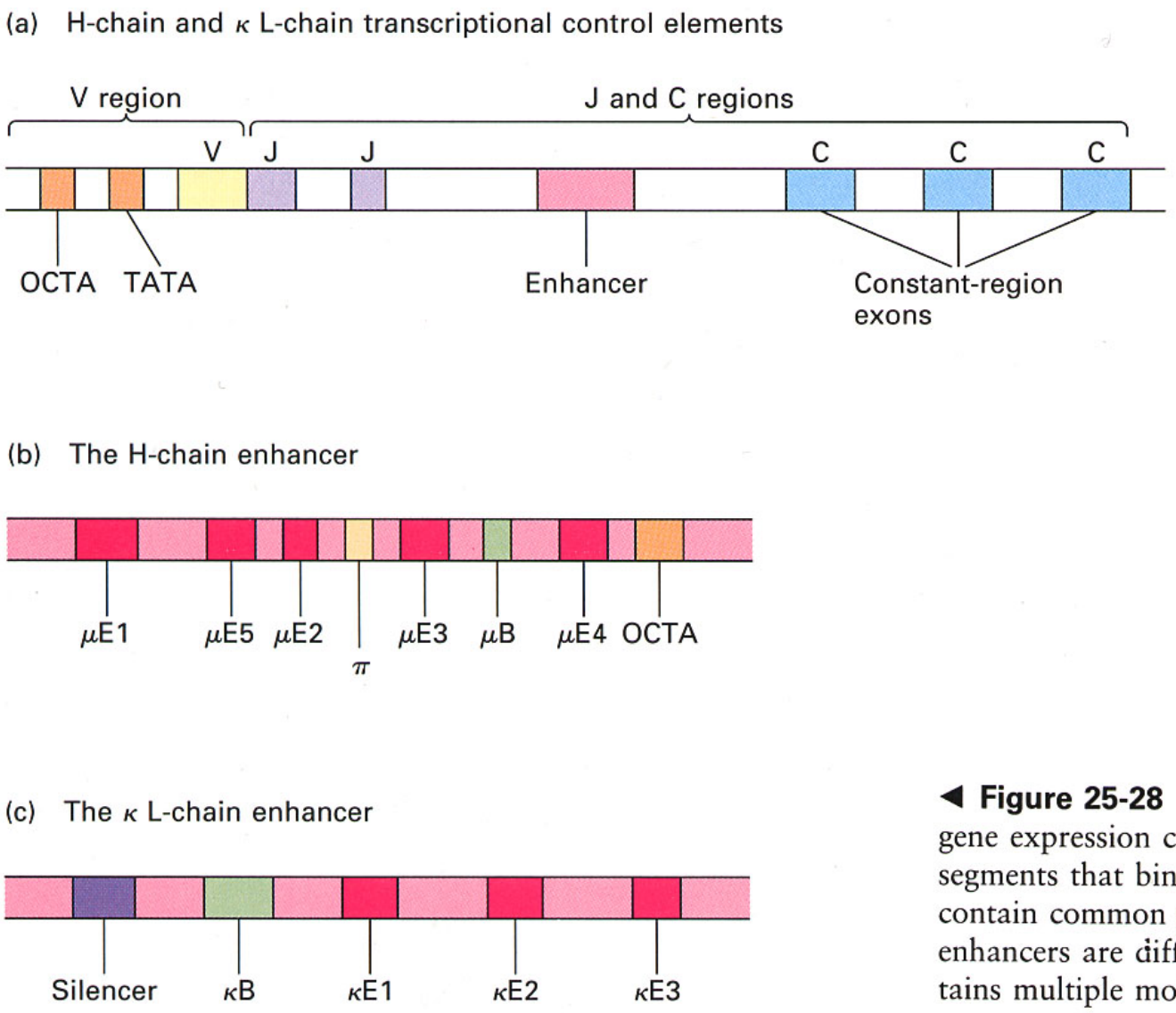
Die IG-Genfamilie hat sehr viele verschieden Mitglieder:



Noch komplizierter sind die Gene für die T-Zell-Rezeptor Ketten



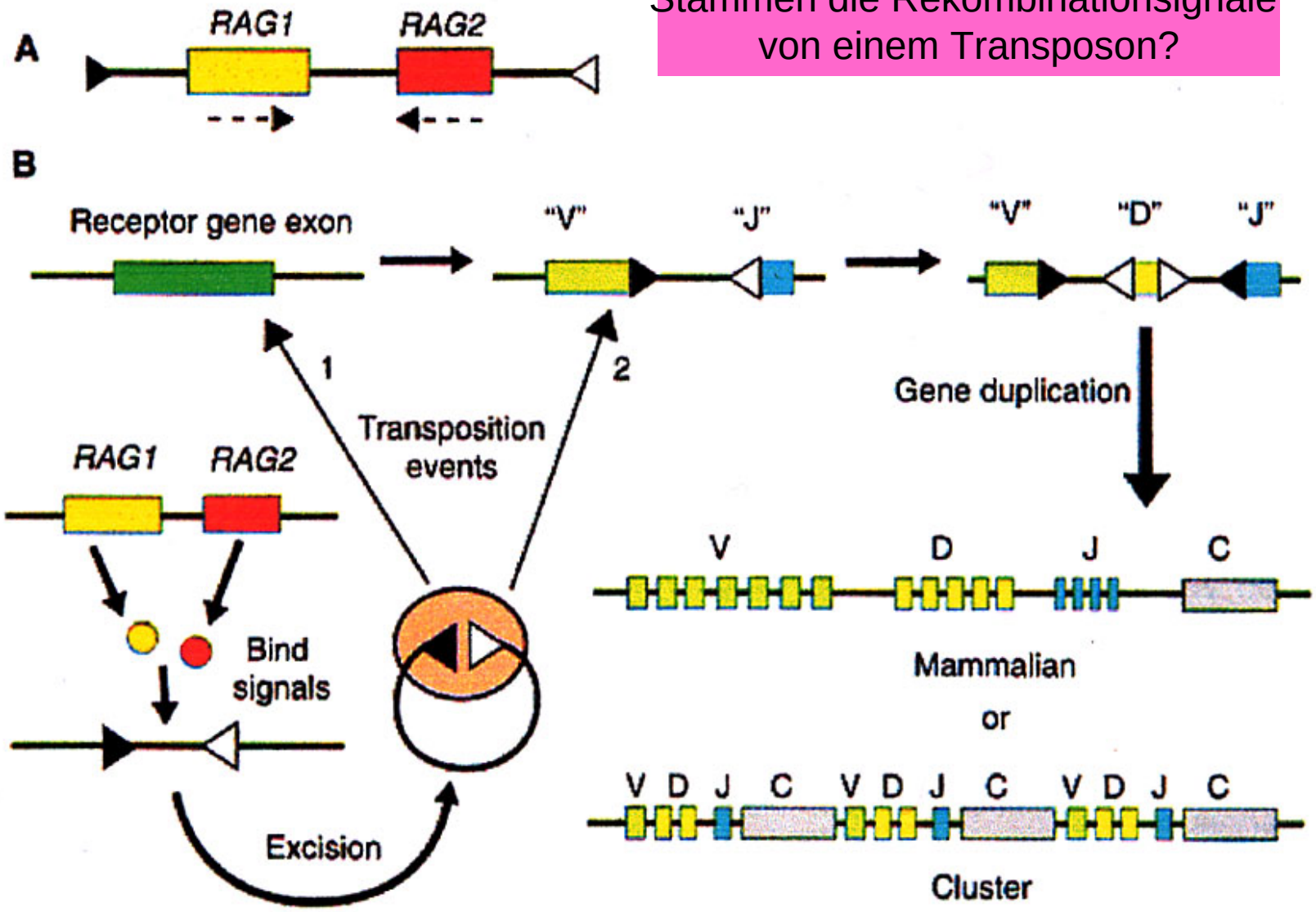
Für die Genregulation ist ein Enhancer im ersten Intron entscheidend:



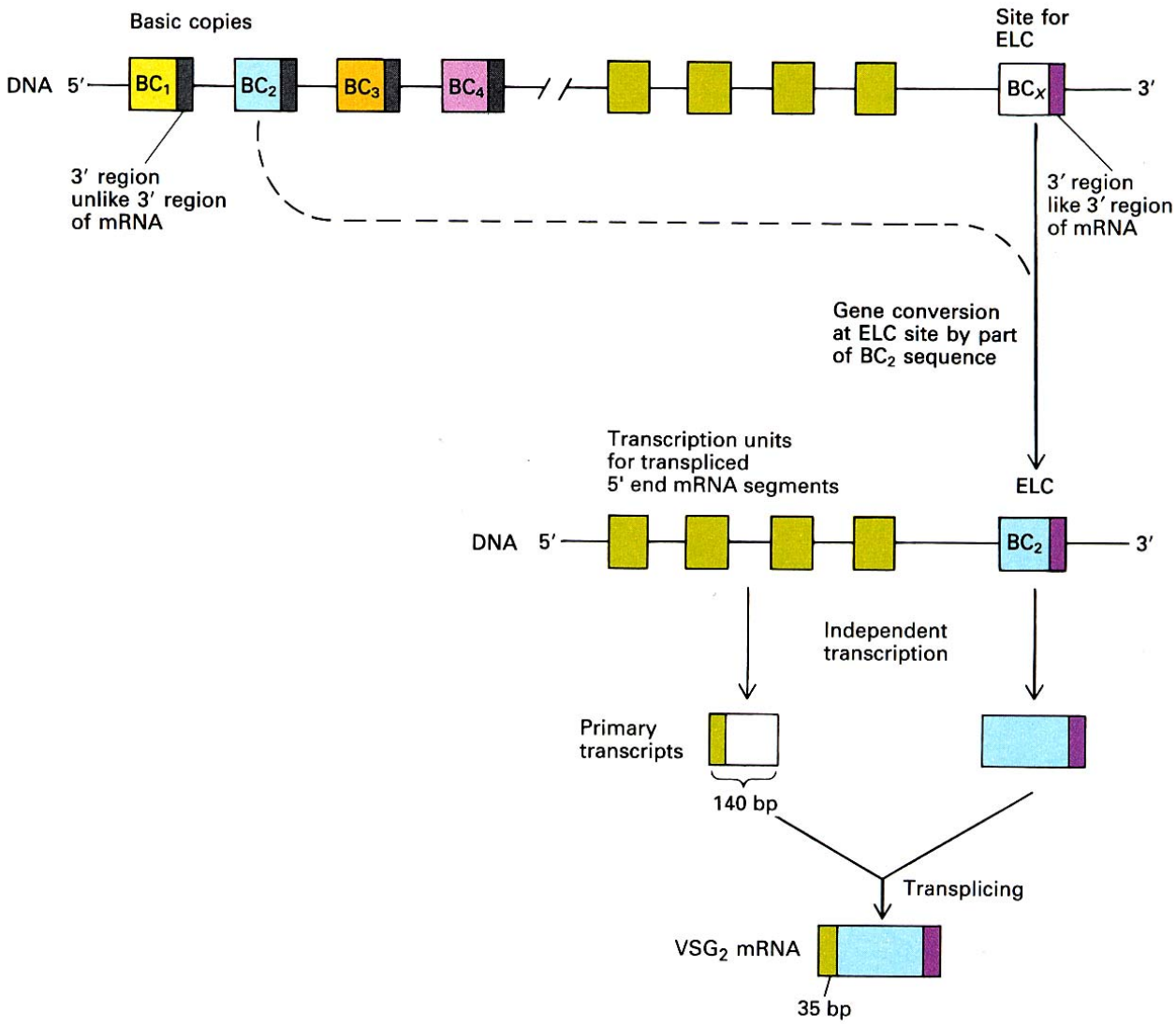
◀ **Figure 25-28** T
gene expression con
segments that bind
contain common pr
enhancers are differ
tains multiple motif

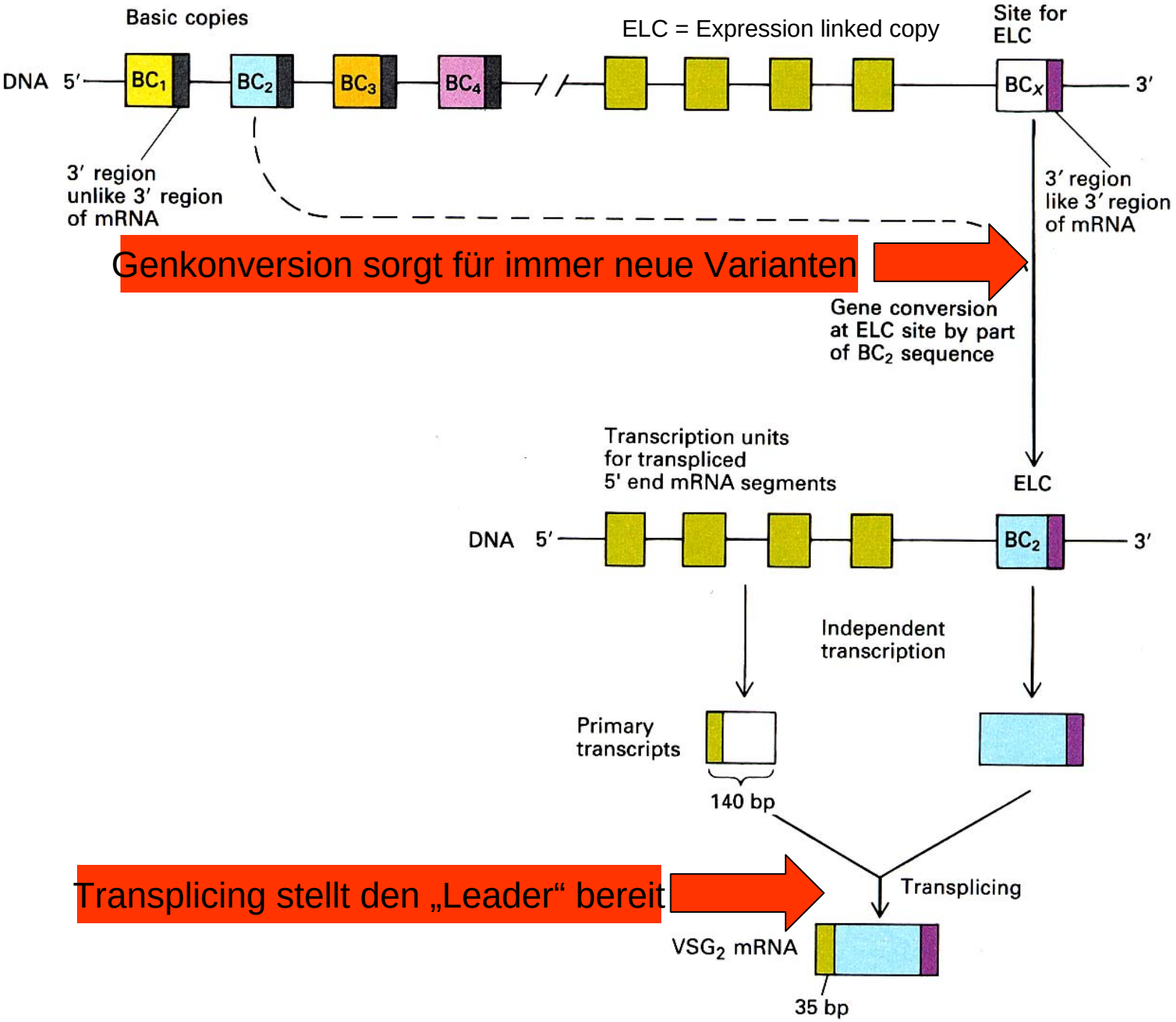
Was hat das alles mit Transposons zu tun?

Stammen die Rekombinationsignale von einem Transposon?

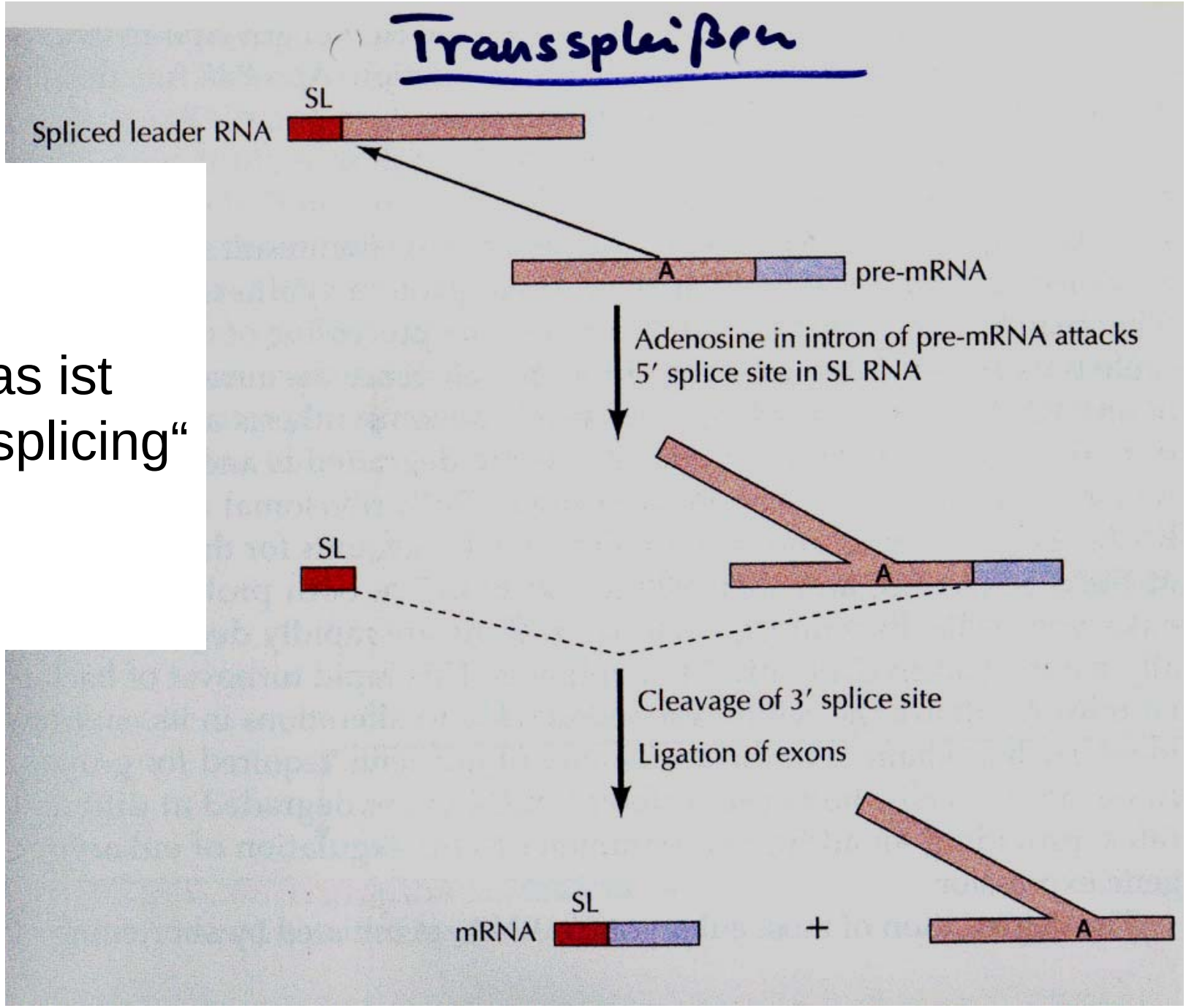


Variabilität bei Oberflächenproteinen von Trypanosomen („VSGs“)




Basic copies
ELC = Expression linked copy
Site for ELC
DNA 5′
BC1
BC2
BC3
BC4
BCX
3′
3′ region unlike 3′ region of mRNA
3′ region like 3′ region of mRNA
Genkonversion sorgt für immer neue Varianten
Gene conversion at ELC site by part of BC2 sequence
Transcription units for transpliced 5' end mRNA segments
ELC
DNA 5′
BC2
3′
Independent transcription
Primary transcripts
140 bp
Transplicing
Transplicing stellt den „Leader“ bereit
VSG2 mRNA
35 bp

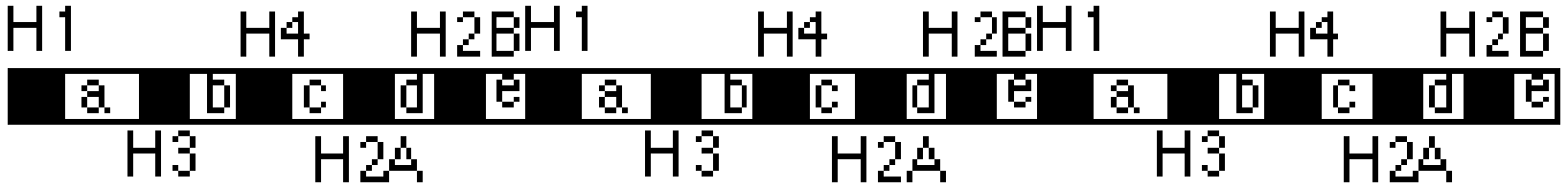
Was ist „Transplicing“



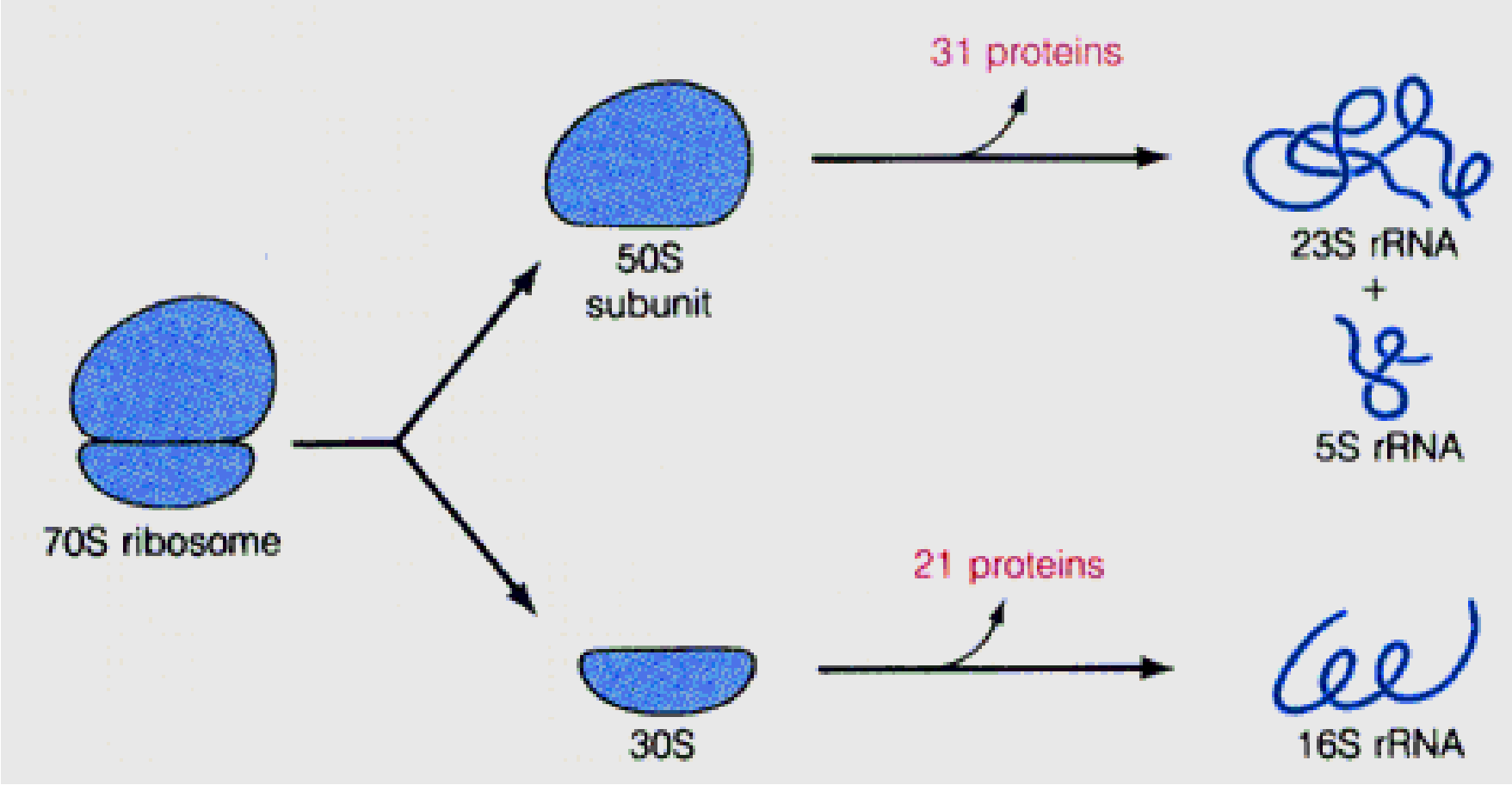
Repetitive Gene:

- Immunglobulingenfamilie
- Gene für rRNA
- Gene für ribosomale Proteine
- Gene tRNA
- Histongene
- Gene für snRNA
- und viele andere

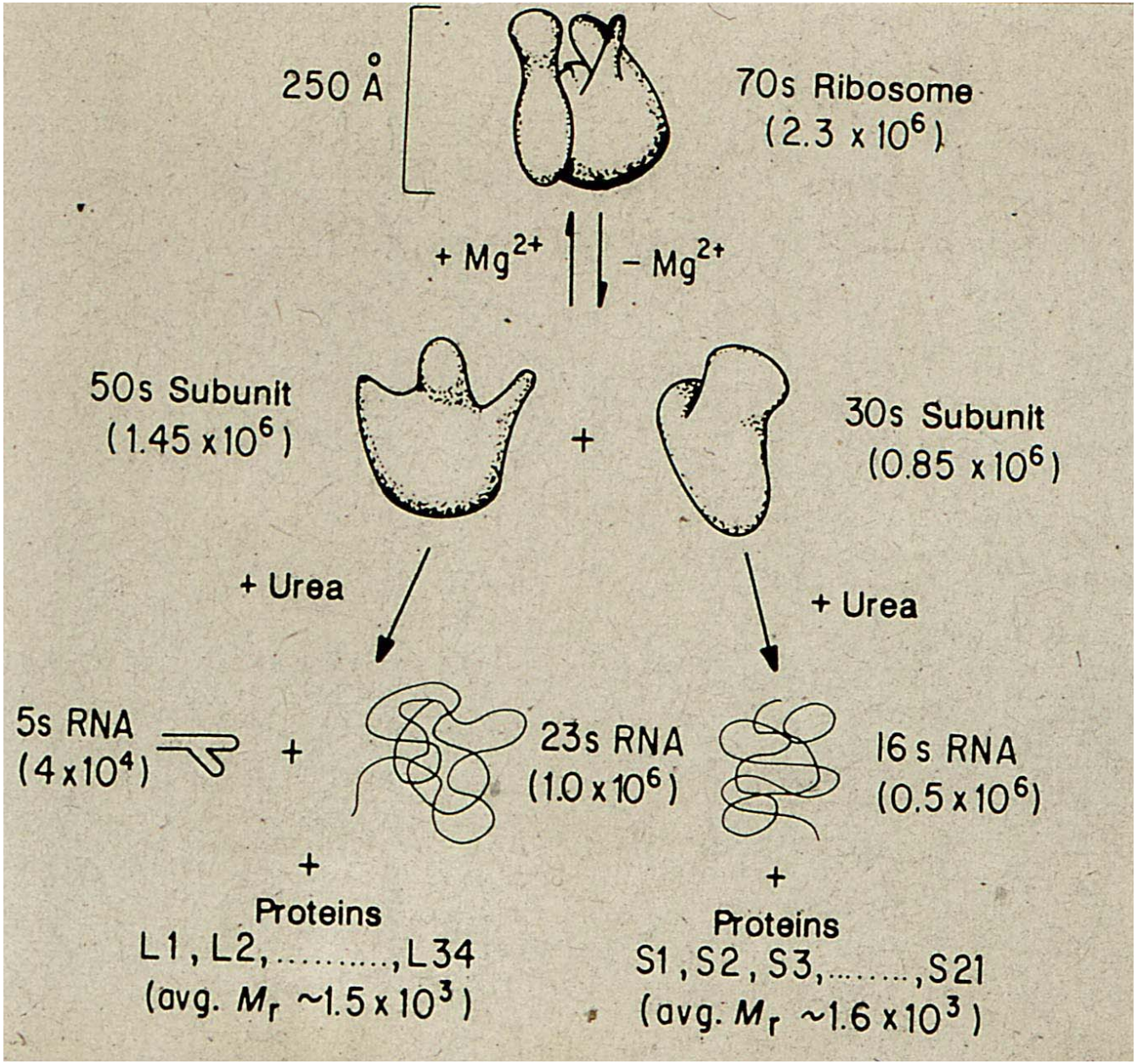
Histongencluster bei Drosophila



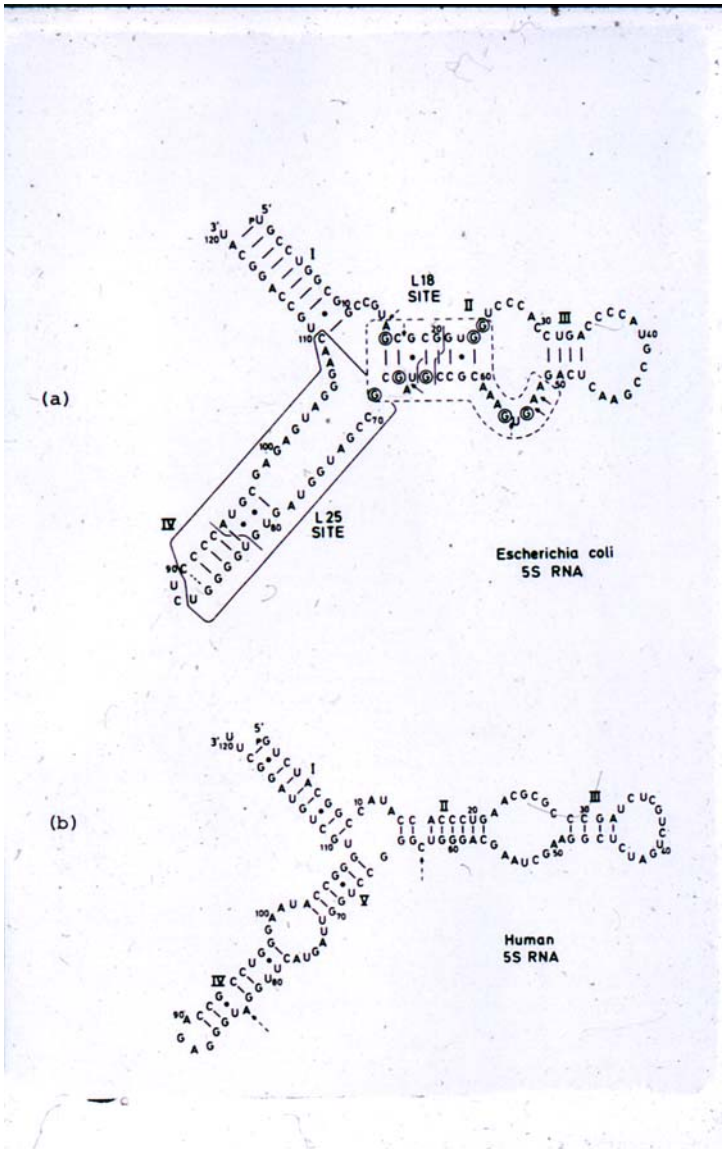
Ribosomen und ribosomale RNA:



Komponenten des Ribosoms



Komponenten des Ribosoms, 5sRNA



Komponenten des Ribosoms, 16sRNA

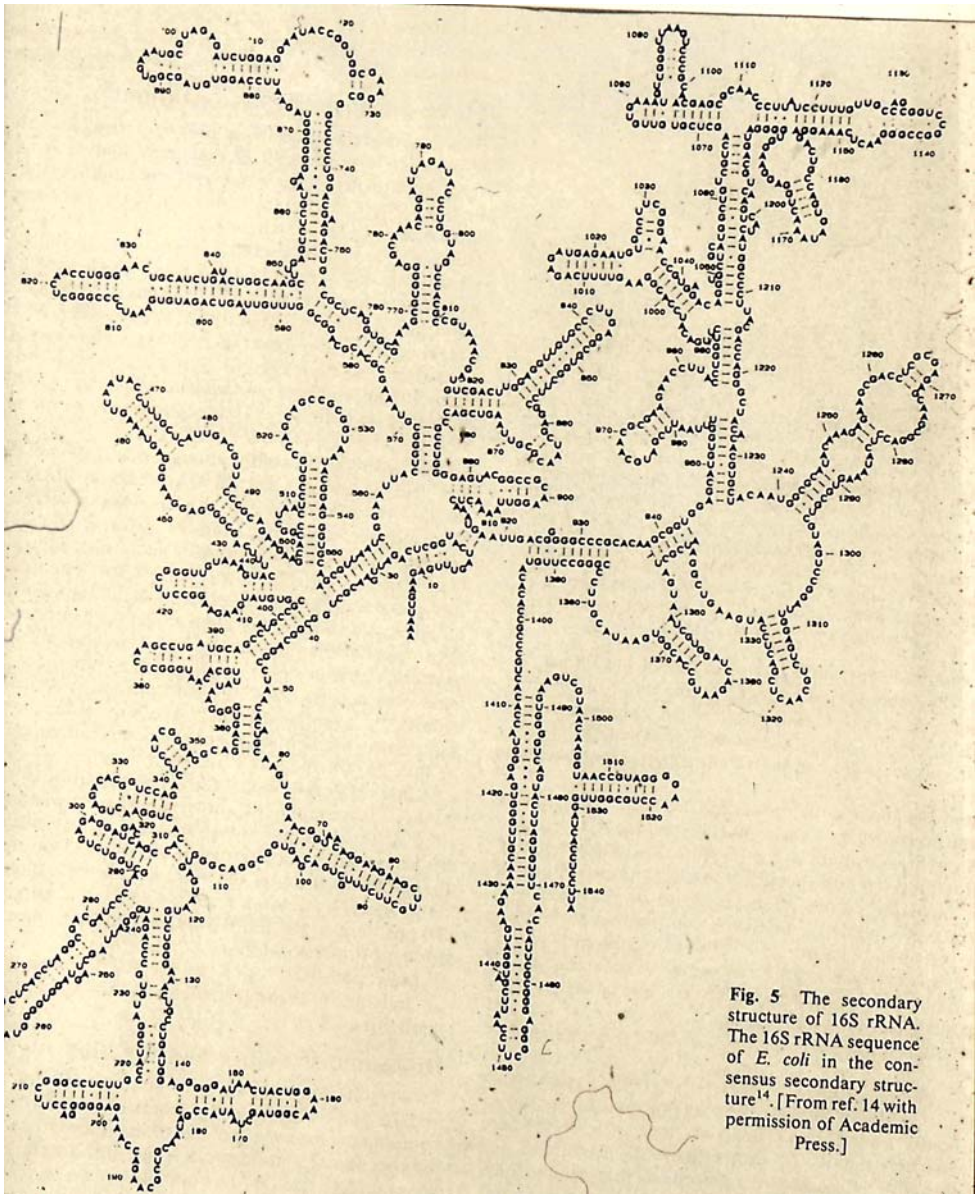
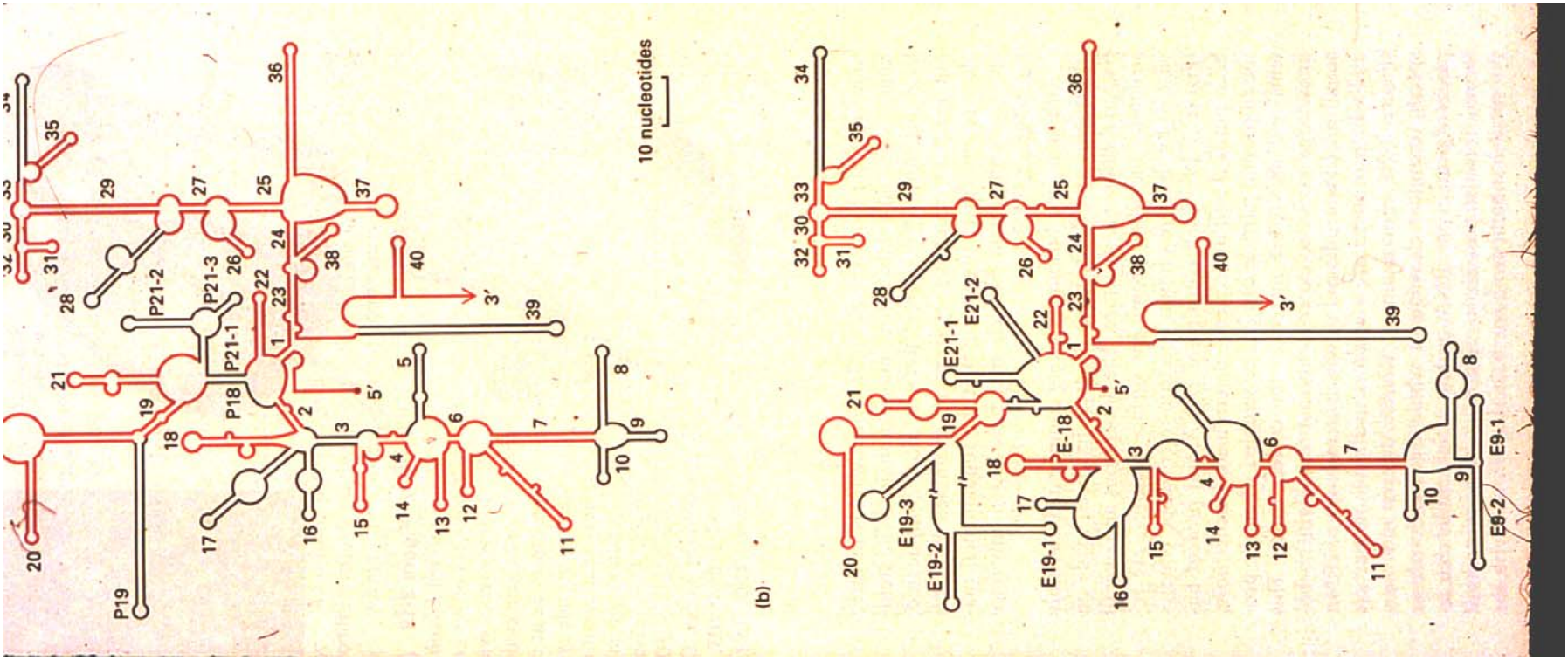
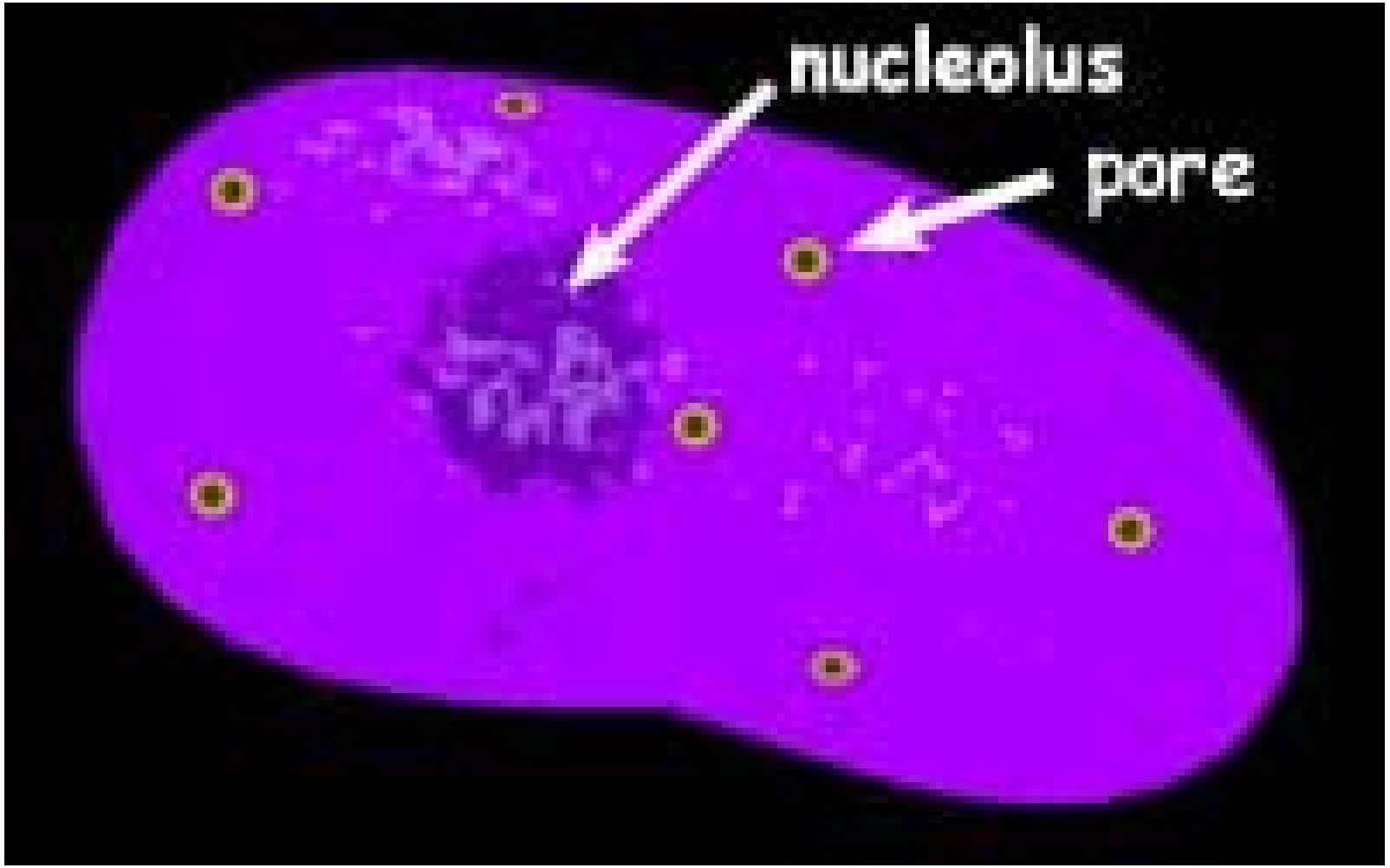


Fig. 5 The secondary structure of 16S rRNA. The 16S rRNA sequence of *E. coli* in the consensus secondary structure[14]. [From ref. 14 with permission of Academic Press.]

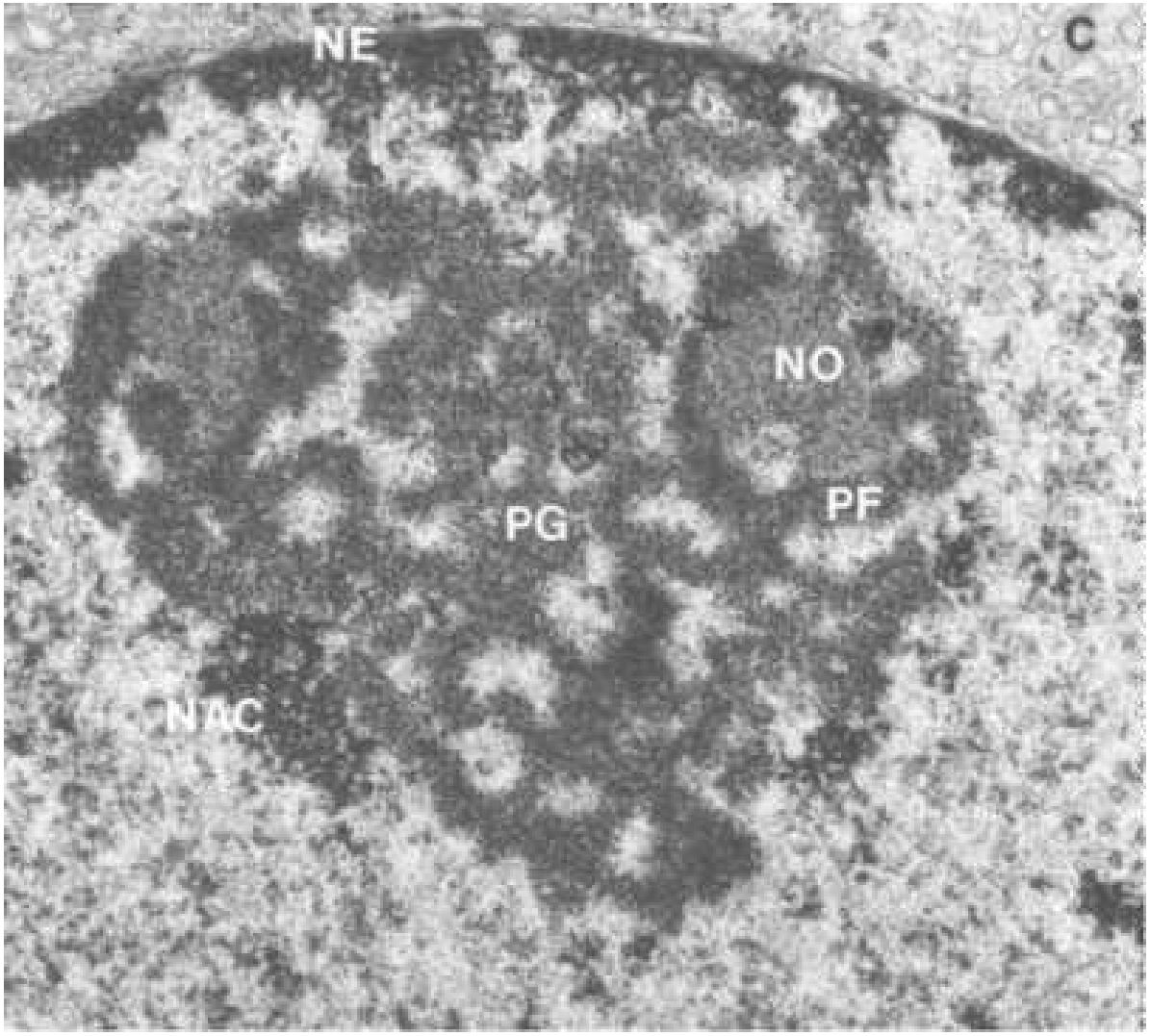
Die rRNA-Sekundärstruktur ist evolutionär extrem konserviert



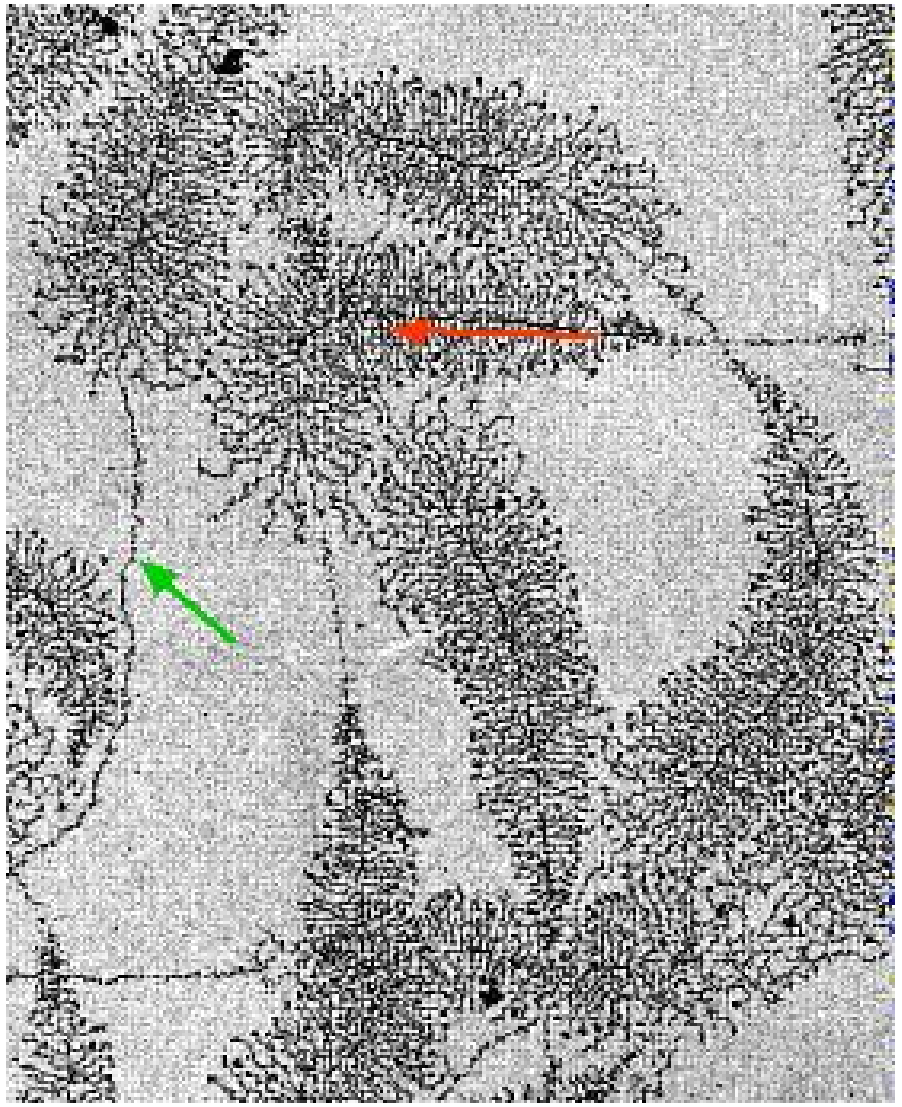
Ribosomen im NUkleolus



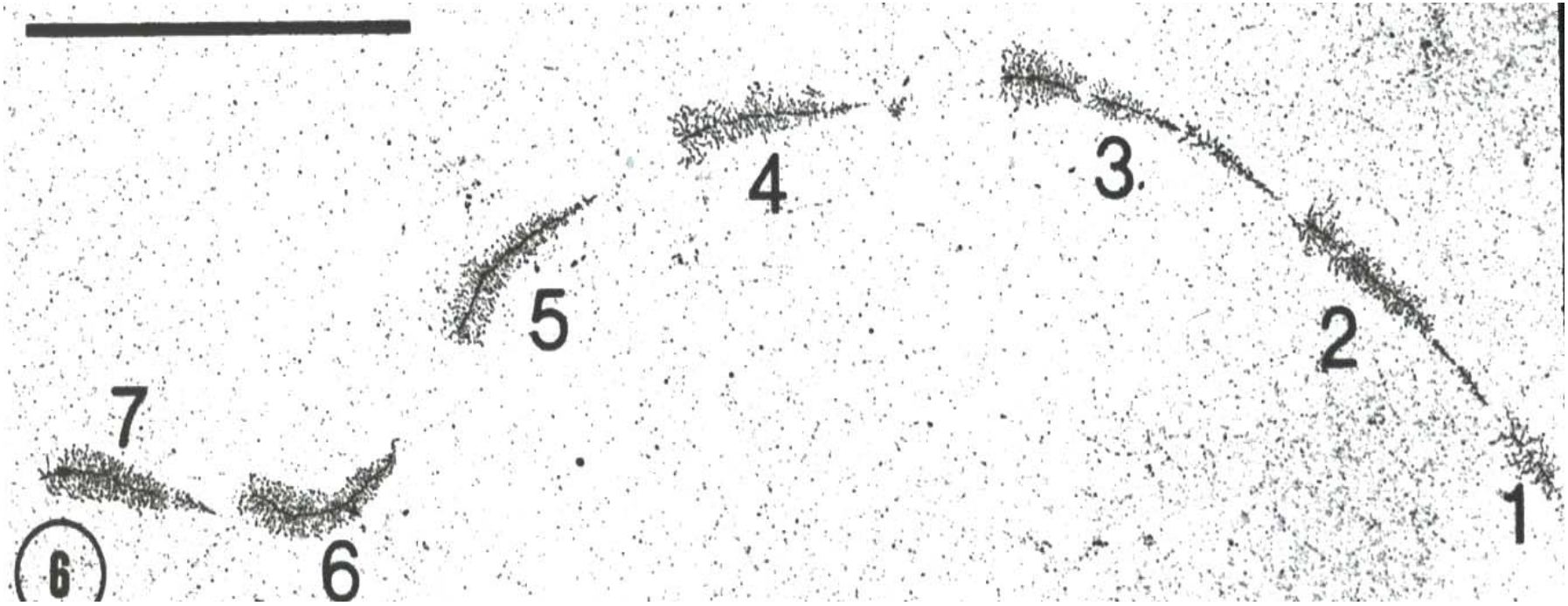
Nukleolus die Ribosomenmanufaktur



Nucleolus im EM:
Aktive Gene für ribosomale RNA

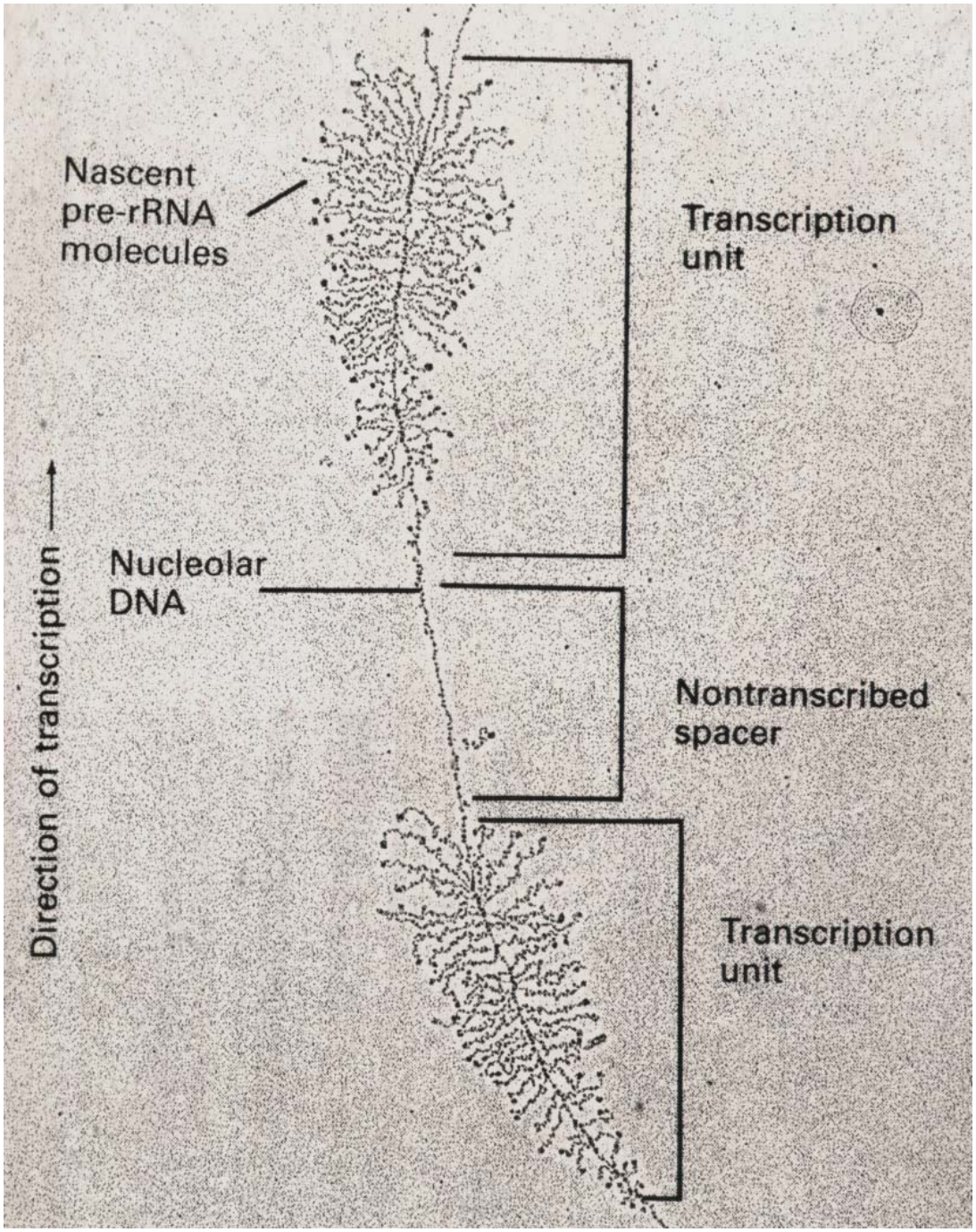


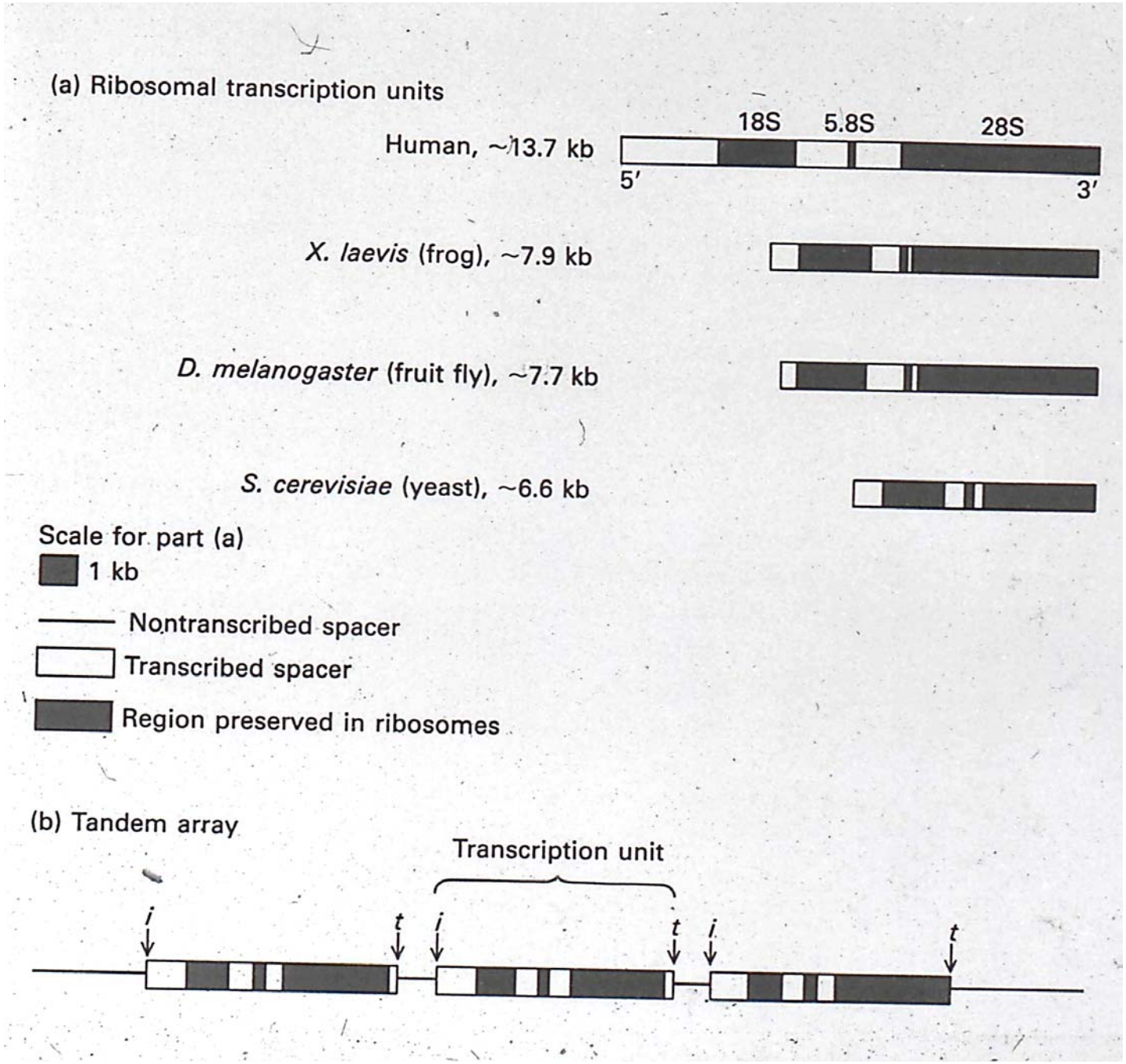
Gene für ribosomale RNA:



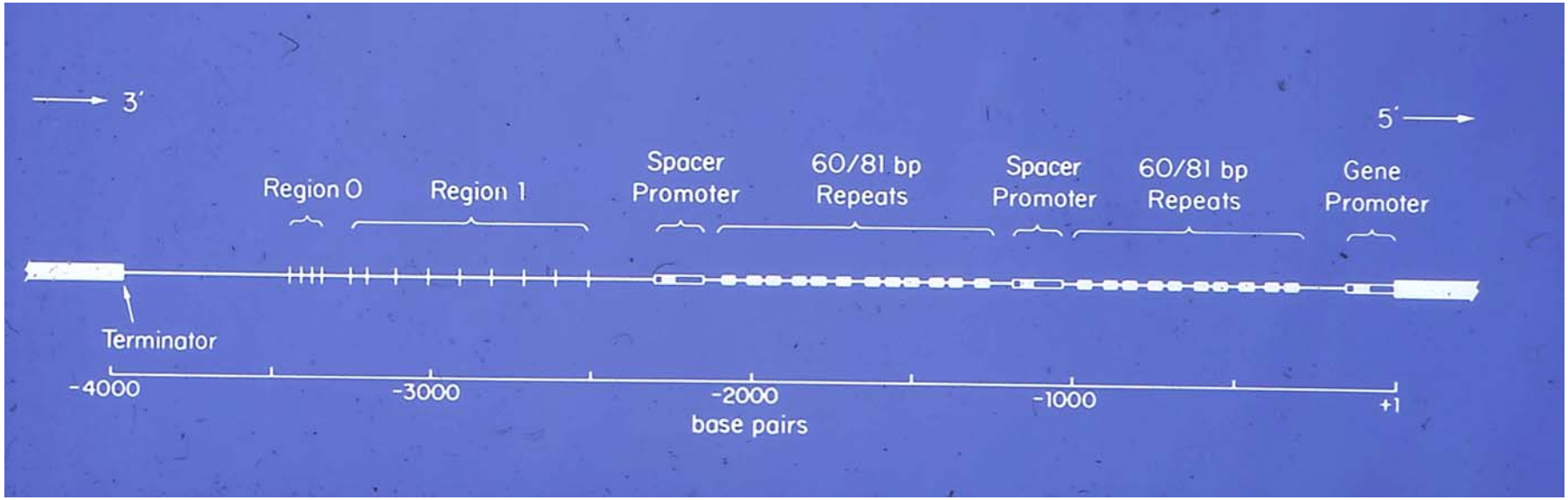
Elektronenmikroskopische Darstellung transkriptionsaktiver Gene
nach sog. „Miller-Spreitung“

rDNA
die Gene für die ribosomalen RNAs

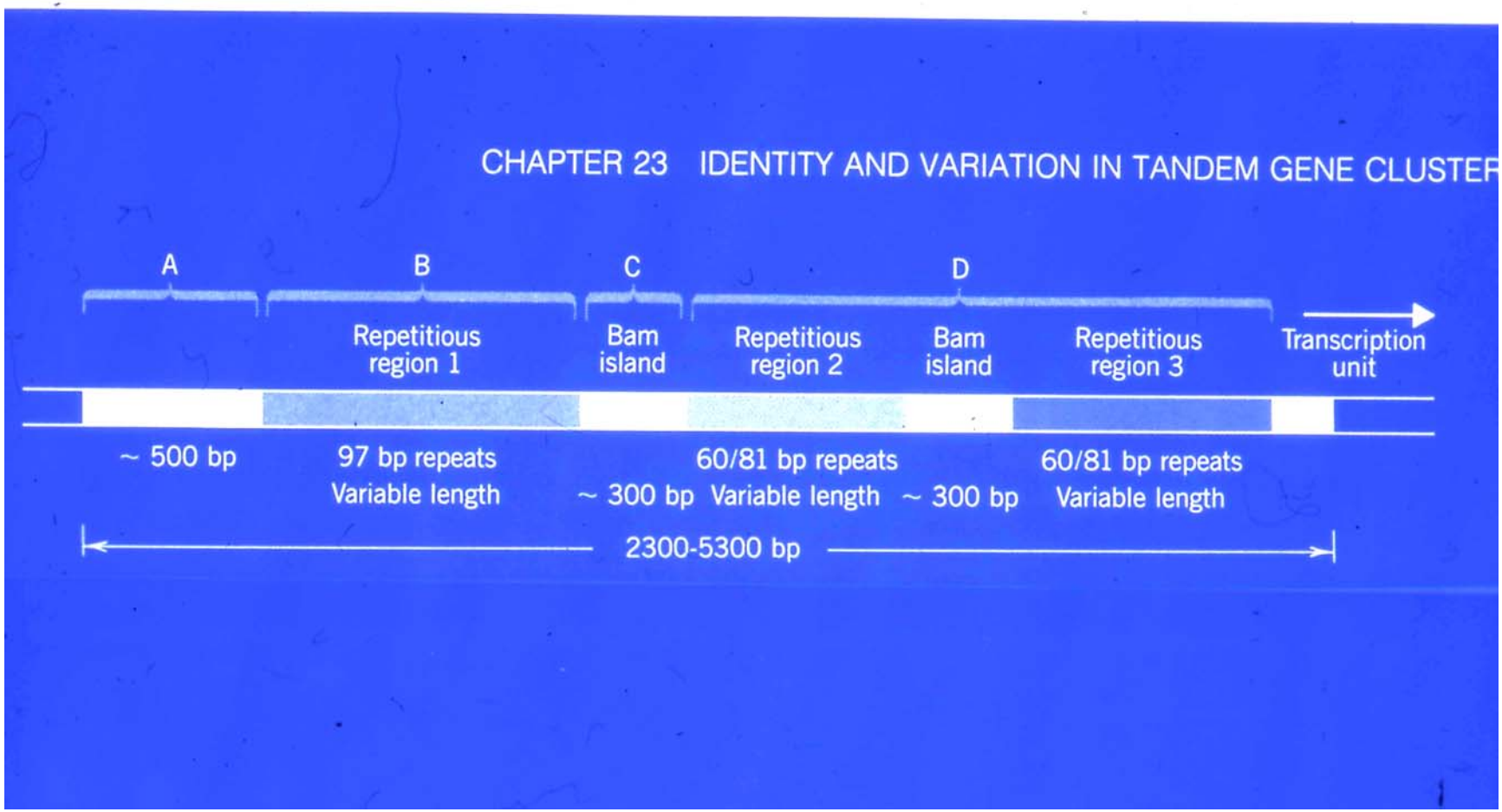



(a) Ribosomal transcription units
18S
5.8S
28S
Human, ~13.7 kb
5′
3′
X. laevis (frog), ~7.9 kb
D. melanogaster (fruit fly), ~7.7 kb
S. cerevisiae (yeast), ~6.6 kb
Scale for part (a)
1 kb
Nontranscribed spacer
Transcribed spacer
Region preserved in ribosomes
(b) Tandem array
Transcription unit
i
t
i
t
i
t

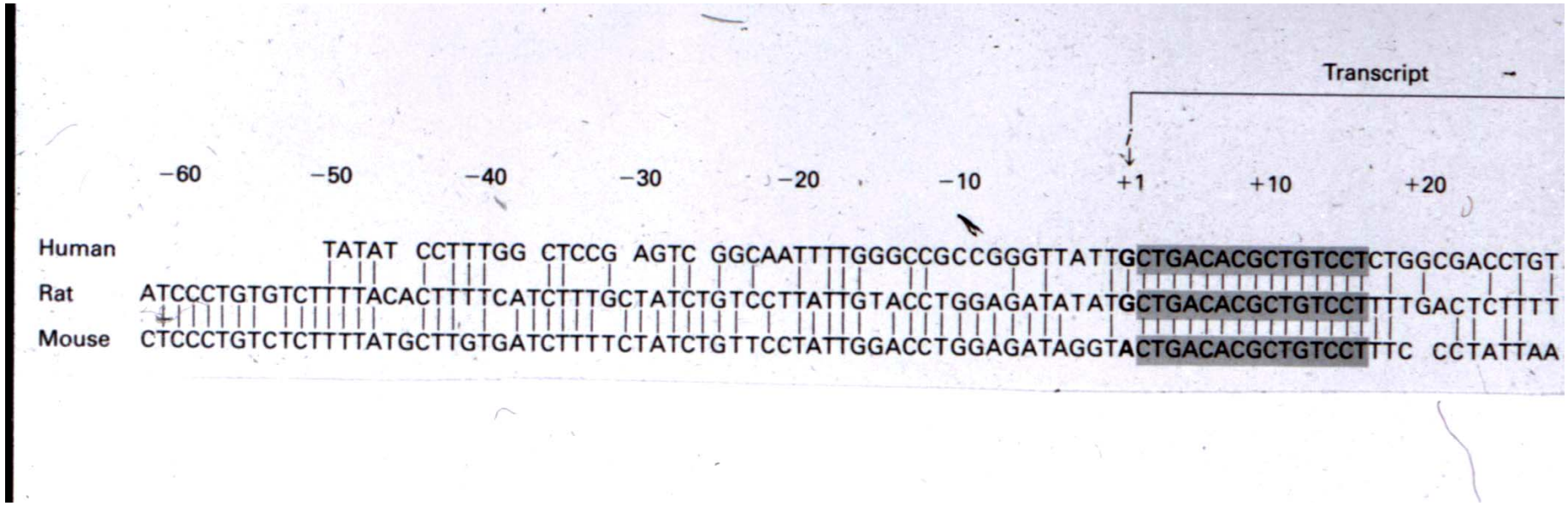
NTS-Promotor Emhancer



rDNA, die NTS-Region



Die RNA-Pol I-Promotorregion ist nicht gut konserviert

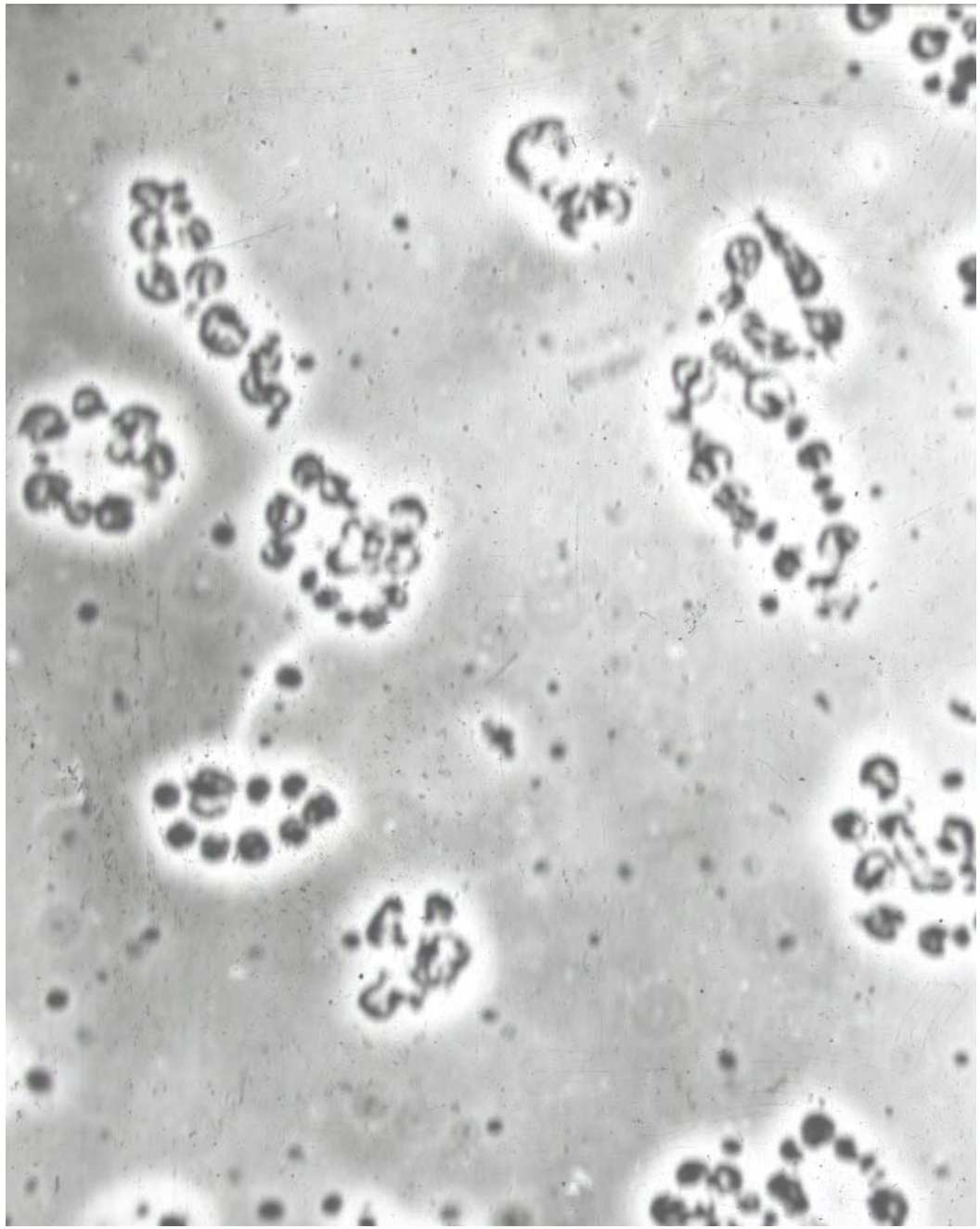


Die Zahl der rDNA-Gene ist in verschiedenen Spezies sehr unterschiedlich:

Table 23.1
There Are Multiple rRNA and tRna Genes in All Genomes

Species	Number of 18S/ 28S Genes	Ratio of rDNA to Total DNA	No. 5S Genes	No. tRNA Genes
E. coli	7	1.0%	7	60
S. cerevisiae	140	5.5%	140	250
D. discoideum	180	17.0%	180	?
D. melanogaster				
(X)	250	1.3%	165	850
(Y)	150			
Human	280	0.4%	2000	1300
X. laevis	450	0.18%	24000	1150

Amplifikation der rDNA beim Gelbrabdkäfer



rDNA,
Amplifikation
rolling circle