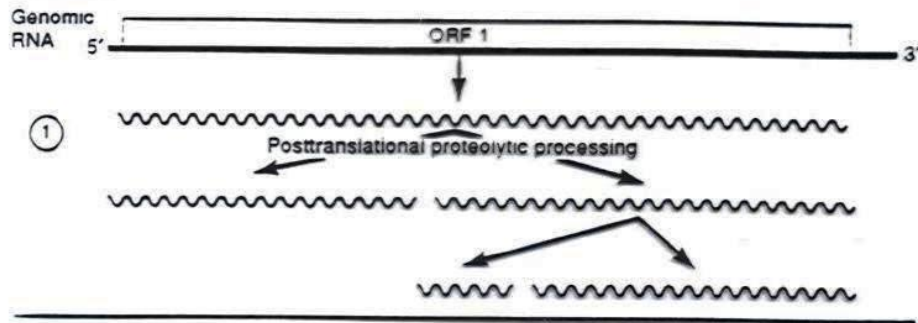


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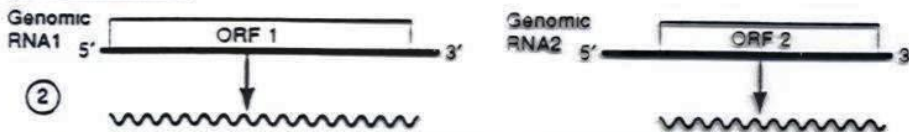
APRESENTAÇÃO 5 **(Outros Grupos de Vírus de RNA +)**

Maria Filomena Caeiro

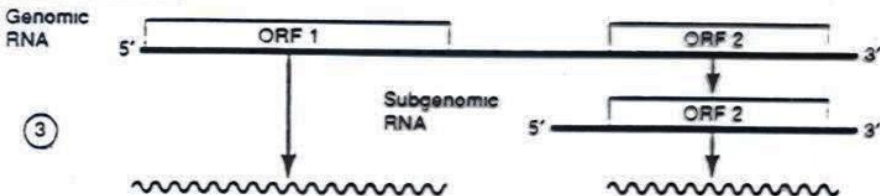
Polyprotein



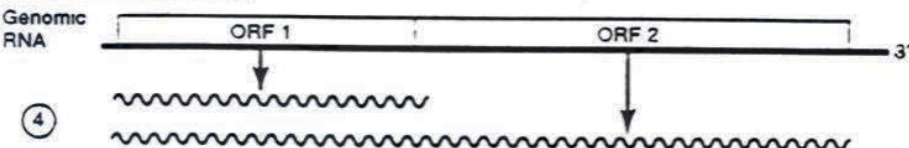
Multipartite genome



Subgenomic RNAs

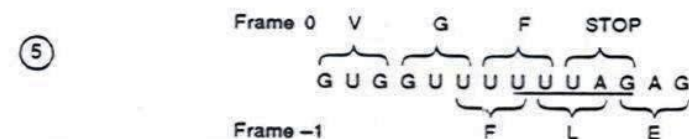


Translational readthrough



Translational frameshift

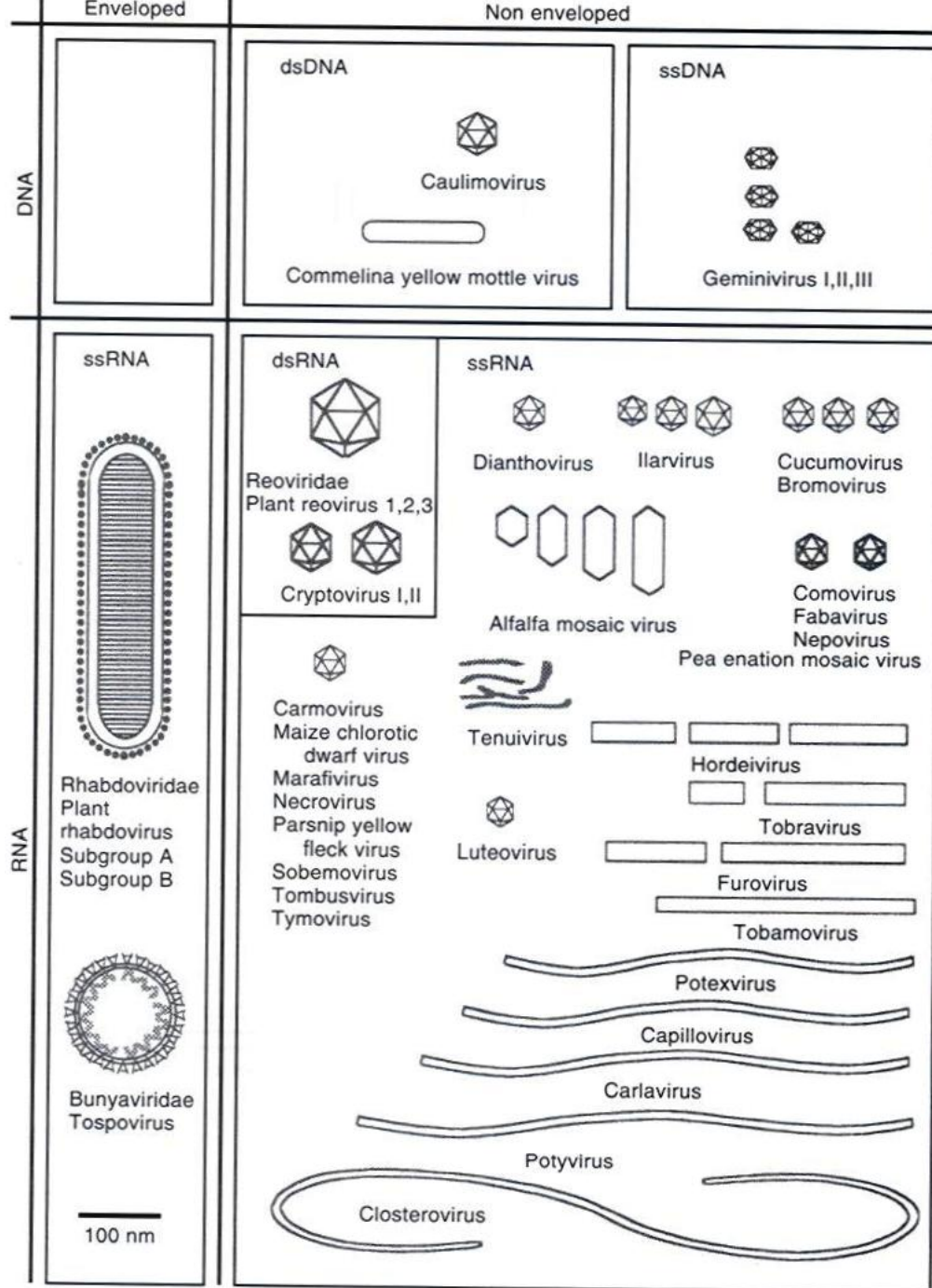
The ribosome bypasses a stop codon in Frame 0 by switching back one nucleotide to Frame -1 at a UUUAG sequence before continuing to read triplets in Frame -1 to give a fusion or transframe protein.



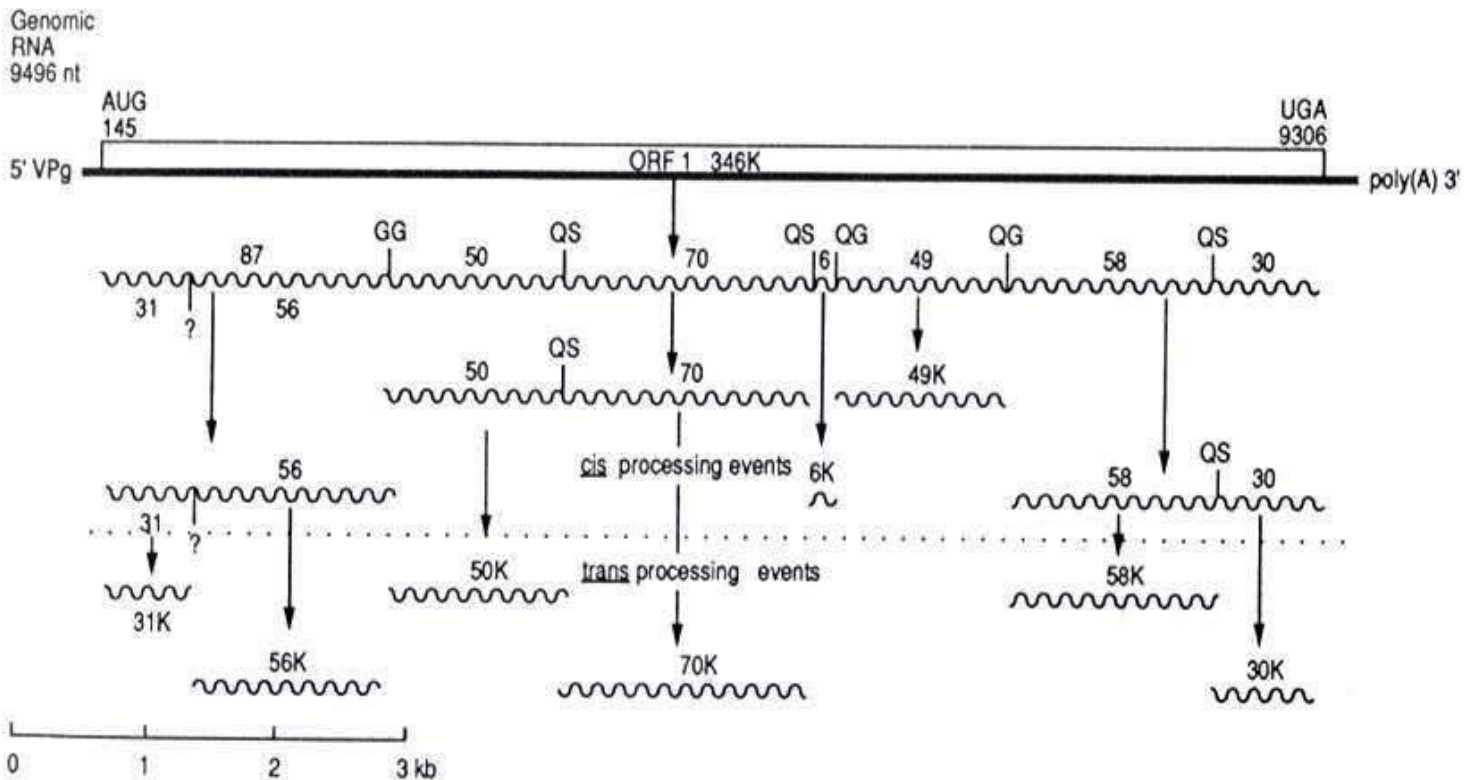
Levy, J. A., Fraenkel-Conrat, H. and Owens, R. A. (1994). "Virology". 3rd edition. Prentice-Hall, Inc.

Summary of Genome Strategies Adopted by 18 Single-Stranded Positive Sense RNA Plant Virus Groups

Number	Strategy (see Fig. 6.2)		Virus group	Number of ORFs	Number of proteins coded
I	One strategy	Polyprotein	<i>Potyvirus</i>	1	8
II	One strategy	Subgenomic RNA	<i>Potexvirus</i>	5	4-5
			<i>Tombusvirus</i>	5	5
III	Two strategies	Subgenomic RNA plus read-through or frameshift protein	<i>Tobamovirus</i>	5	4-5
			<i>Luteovirus</i>	6	6-7
			<i>Carmovirus</i>	5	5-7
IV	Two strategies	Subgenomic RNAs and polyprotein	<i>Tymovirus</i>	3	3-5
			<i>Sobemovirus</i>	4	4-5
V	Two strategies	Multipartite genome and polyprotein	<i>Comovirus</i>	2	≈9
			<i>Nepovirus</i>	2	≈6
VI	Two strategies	Subgenomic RNAs and multipartite genome	<i>Bromovirus</i>	4	4
			<i>Cucumovirus</i>	4	4
			Alfalfa mosaic virus	4	4
			<i>Ilarvirus</i>	4	4
			<i>Hordeivirus</i>	7	7
VII	Three strategies	Subgenomic RNAs, multipartite genome, and read-through protein (or frameshift)	<i>Tobravirus</i>	5	5
			<i>Furovirus</i>	9	6-9
			<i>Dianthovirus</i>	4	4



Levy, J. A., Fraenkel-Conrat, H. and Owens, R. A. (1994). "Virology". 3rd edition. Prentice-Hall, Inc.



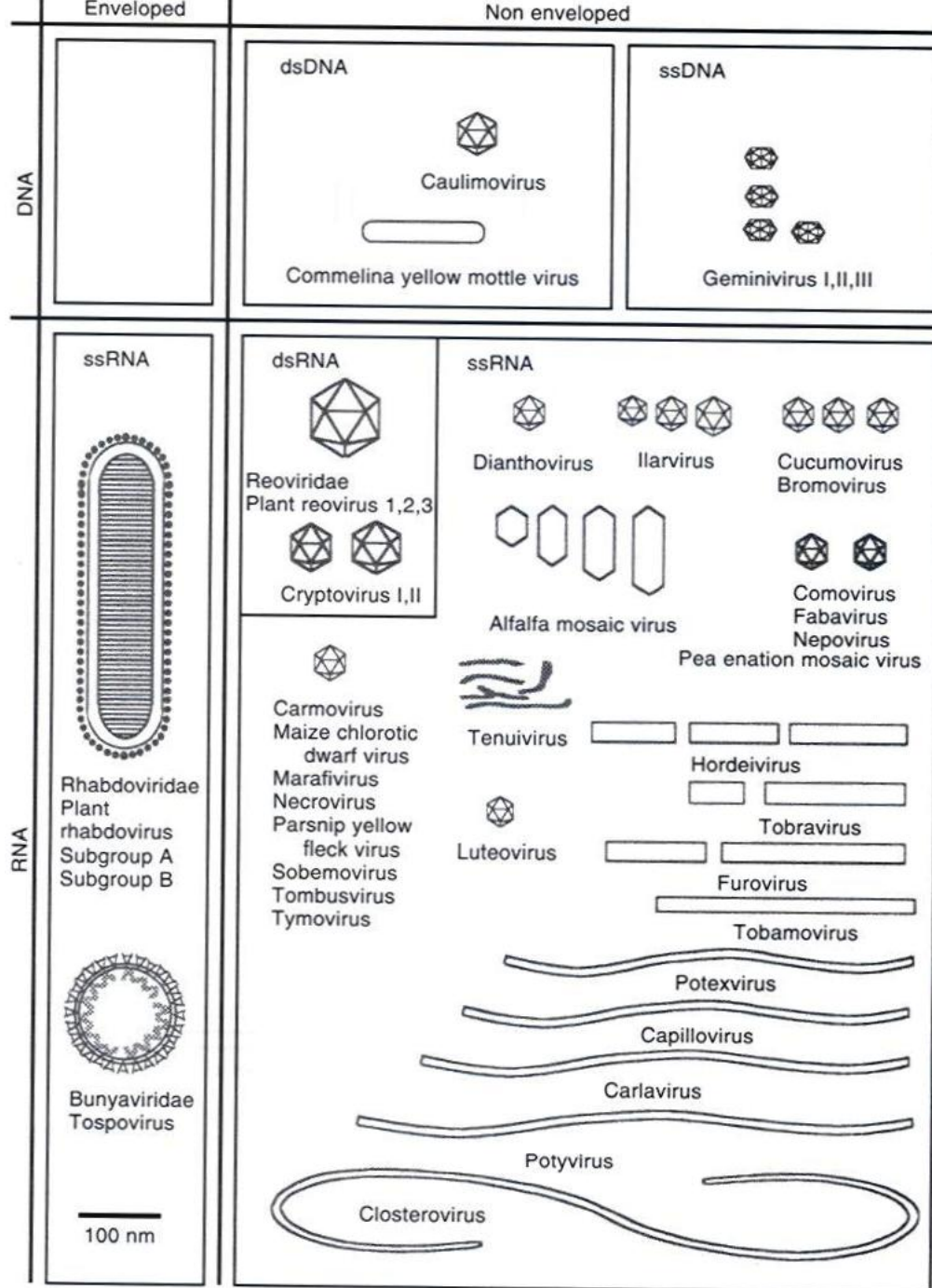
Proteinase cleavage sites QS = gln-ser ; QG = gln-gly ; GG = gly-gly

Protein functions :- 31K , cell-to-cell movement ; 56K , proteinase and insect transmission ; 50K , proteinase ; 70K , replication ; 6K , ? ; 49K , proteinase ; 58K polymerase ; 30K , coat protein.

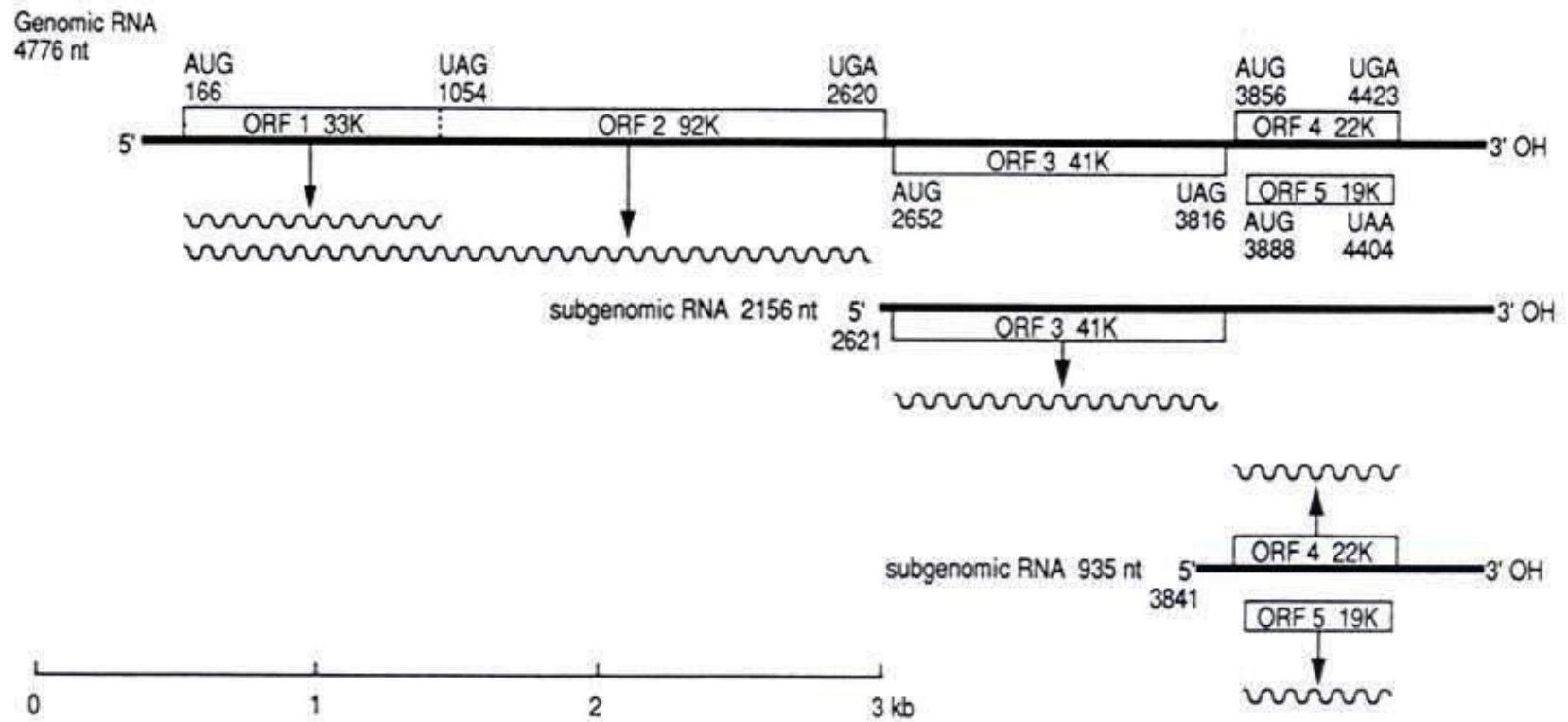
..... indicates cis or trans processing

Figure 7.1 Organization and expression of a *Potyvirus* genome (TEV).

Matthews, R. E. F. (1991).
"Plant Virology". 3rd edition.
Academic Press, Inc.

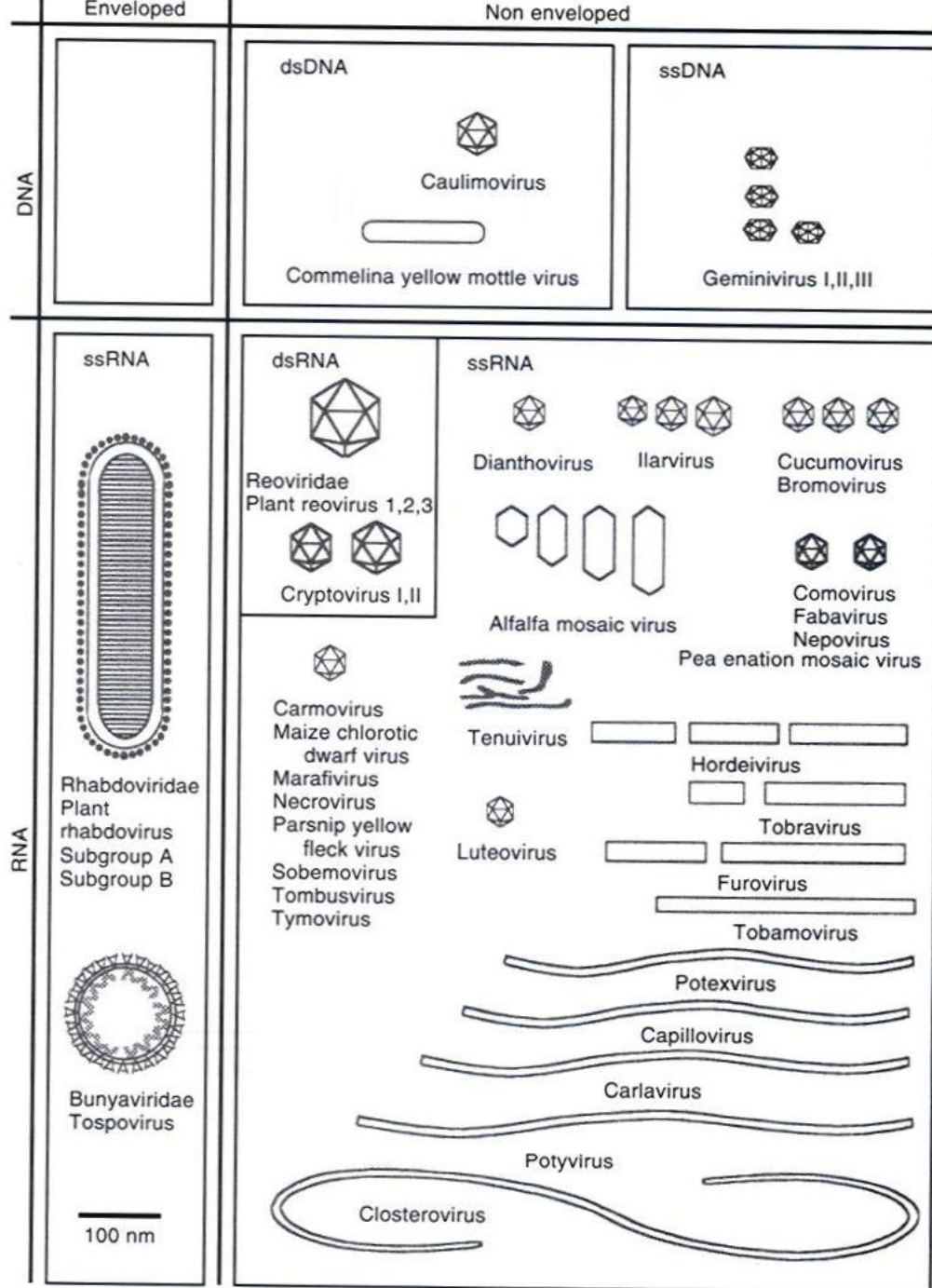


Levy, J. A., Fraenkel-Conrat, H. and Owens, R. A. (1994). "Virology". 3rd edition. Prentice-Hall, Inc.



Protein functions :- 33K , 92K polymerase ? ; 41K , coat protein ; 22K , ? ; 19K , ?

Figure 7.4 Organization and expression of a *Tombusvirus* genome. (TBSV, cherry strain).



Levy, J. A., Fraenkel-Conrat, H. and Owens, R. A. (1994). "Virology". 3rd edition. Prentice-Hall, Inc.

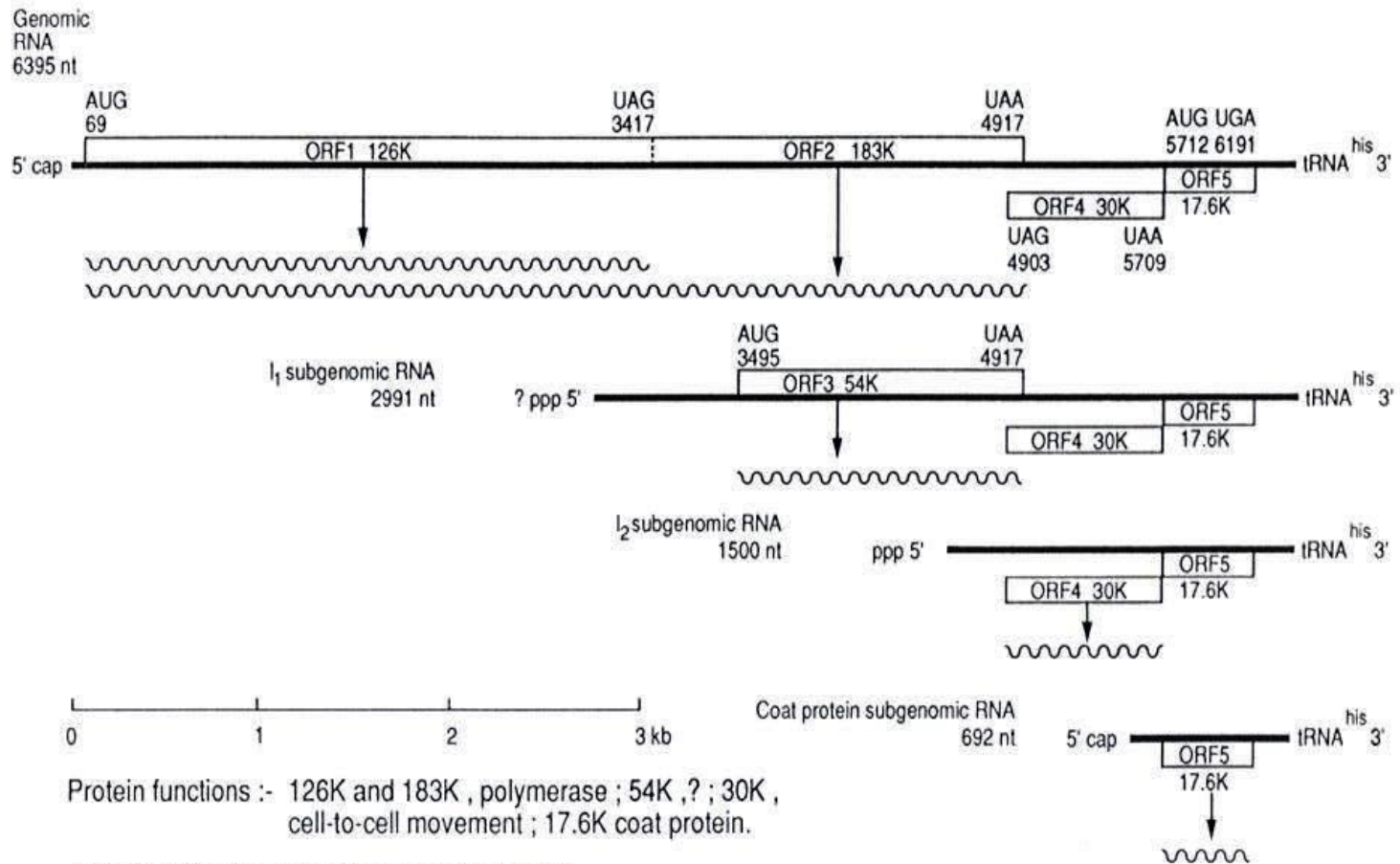
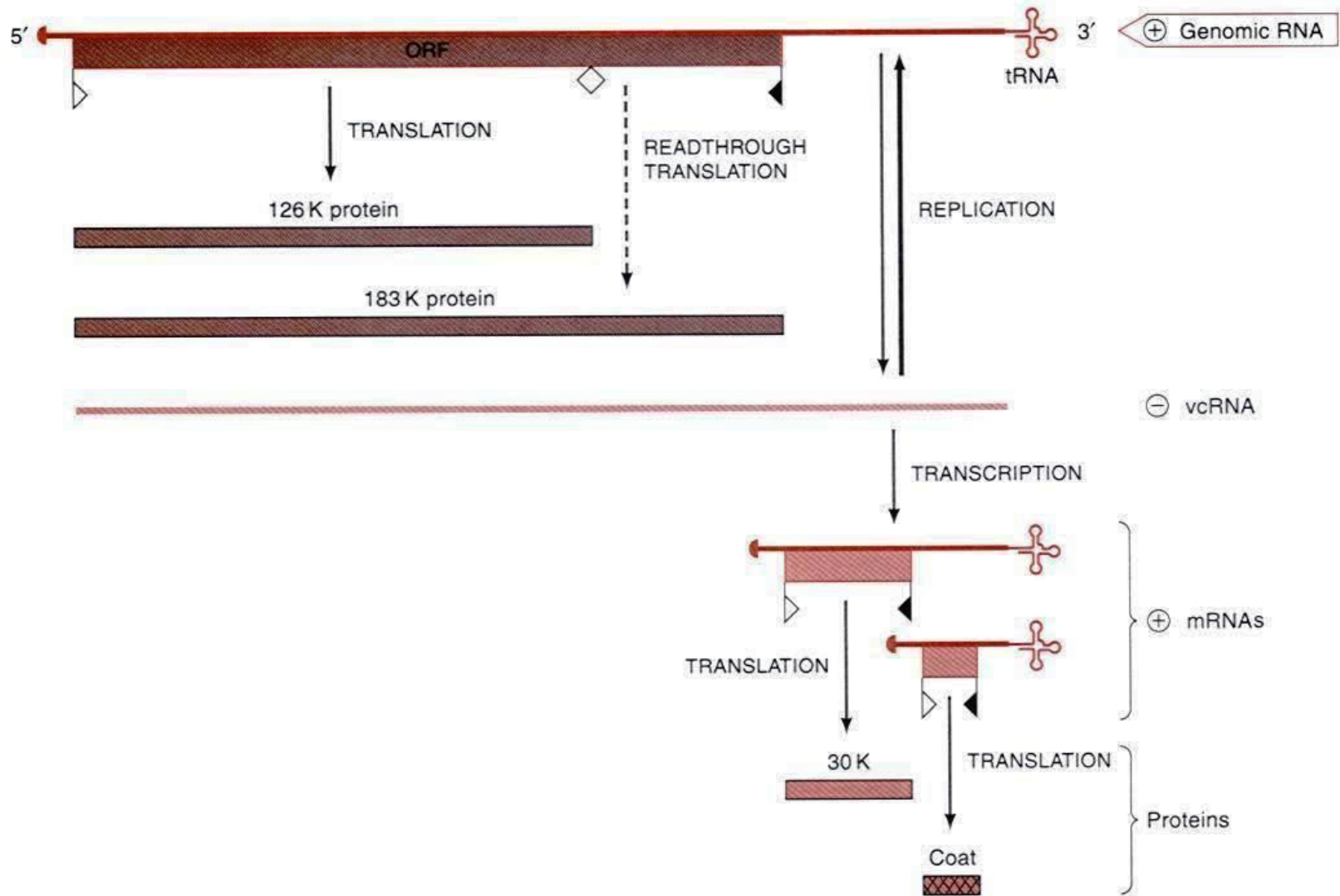


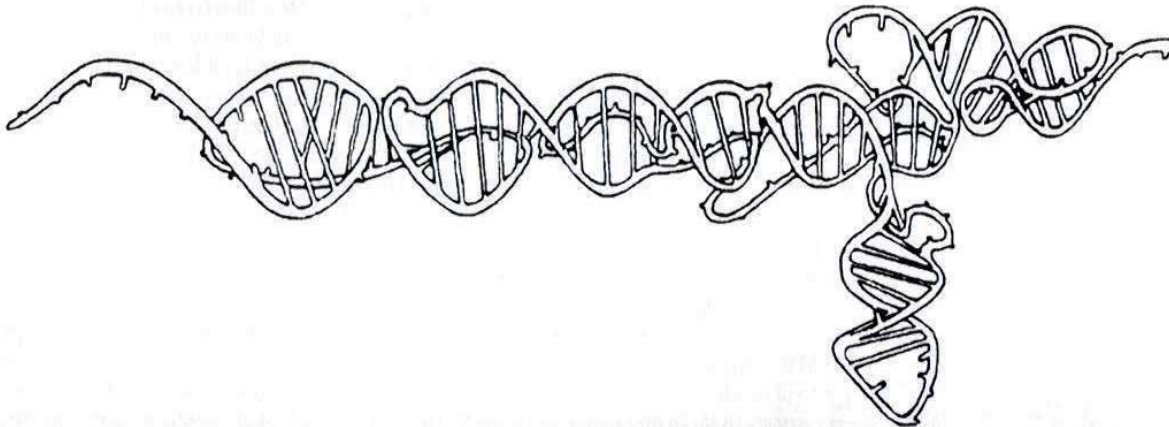
Figure 7.5 Organization and expression of a *Tobamovirus* genome (TMV, Vulgare strain).

Matthews, R. E. F. (1991).
 "Plant Virology". 3rd edition.
 Academic Press, Inc.



Singer, M. and Berg, P. (1997).
 "Exploring Genetic Mechanisms".
 University Science Books. Sausalito,
 California.

Proposed structure for the 3' noncoding region of TMV RNA (vulgaris strain). The tRNA-like structure is at the right; between this structure and the end of the coat protein gene is a stalk-like structure containing four pseudoknots. (a) Schematic representation; (b) three-dimensional artist's representation. (From C. W. A. Pleij et al. (1987) In *Positive-strand RNA viruses*, eds. M. A. Brinton and R. R. Rueckert, 299-316. Alan R. Liss, New York)



Levy, J. A., Fraenkel-Conrat, H. and Owens, R. A. (1994). "Virology". 3rd edition. Prentice-Hall, Inc.

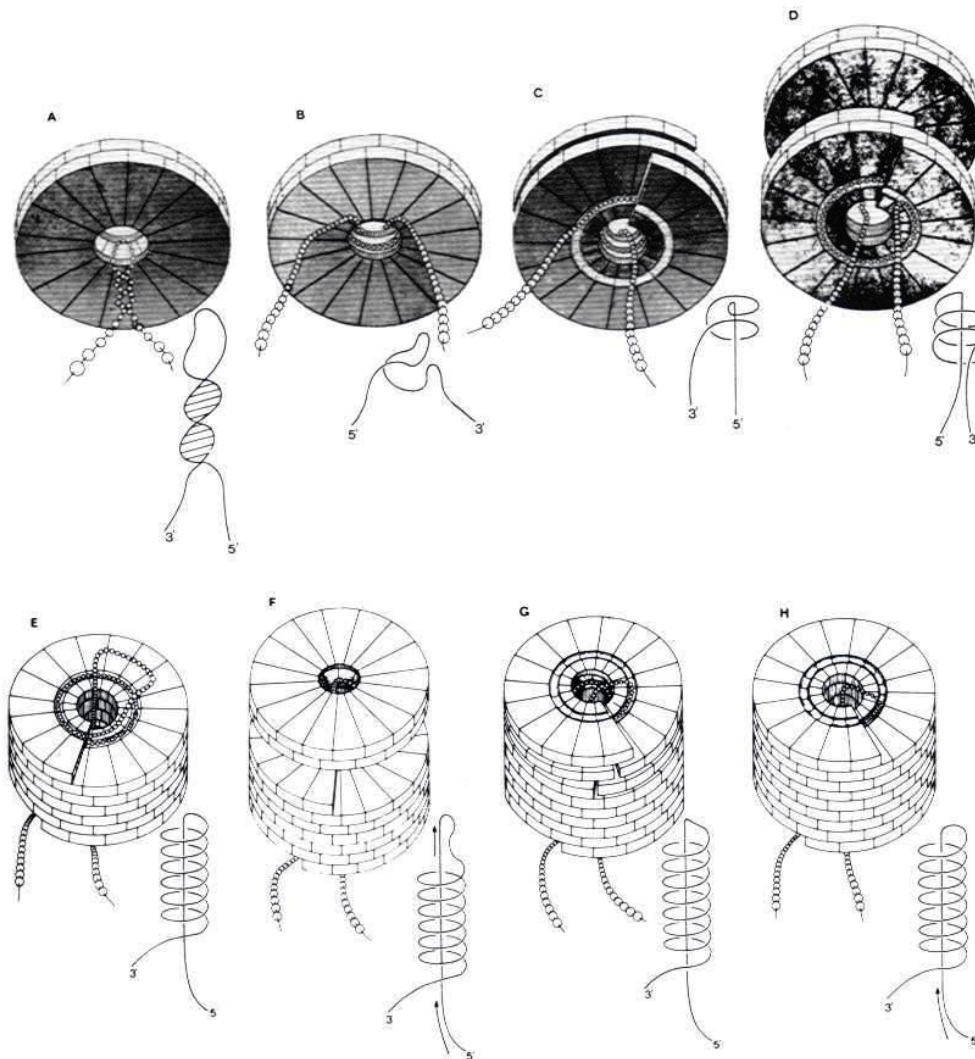
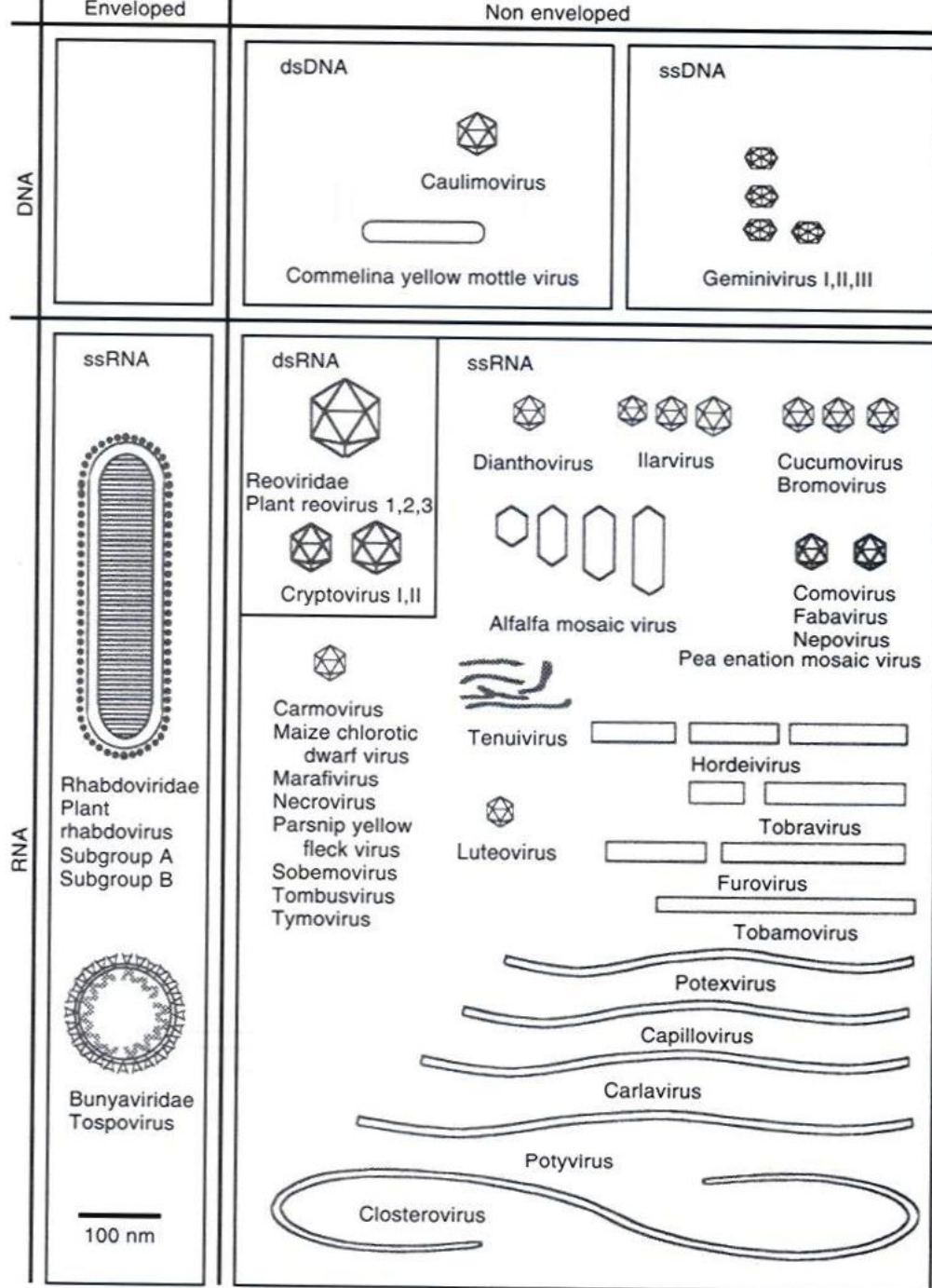
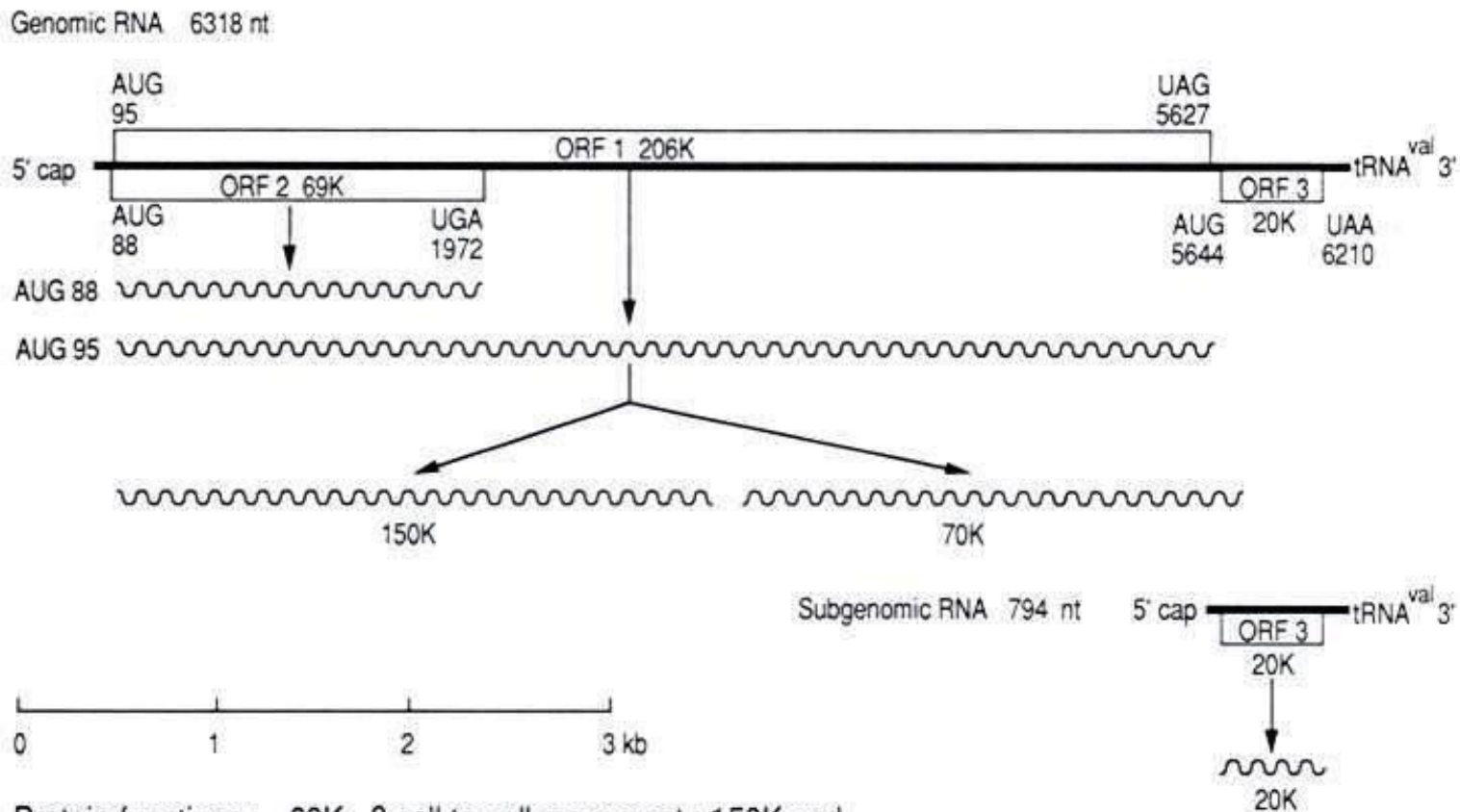


Figure 7.9 Model for the assembly of TMV; (A–C) initiation; (D–H) elongation. (A) The hairpin loop inserts into the central hole of the 20 S disk. This insertion is from the lower side of the disk as viewed in Fig. 5.10. It is not yet apparent how the correct side for entry is chosen. (B) The loop opens up as it intercalates between the two layers of subunits. (C) This protein-RNA interaction causes the disk to switch to the helical lockwasher form (a protohelix). Both RNA tails protrude from the same end. The lockwasher-RNA complex is the beginning of the helical rod. (D) A second double disk can add to the first on the side away from the RNA tails. As it does so it switches to helical form and two more turns of the RNA become entrapped. (E–H) Growth of the helical rod continues in the 5' direction as the loop of RNA receives successive disks, and the 5' tail of the RNA is drawn through the axial hole. In each drawing the three-dimensional state of the RNA strand is indicated. (Courtesy of P. J. G. Butler. Copyright © Medical Research Council.)

Matthews, R. E. F. (1991).
 "Plant Virology". 3rd edition.
 Academic Press, Inc.

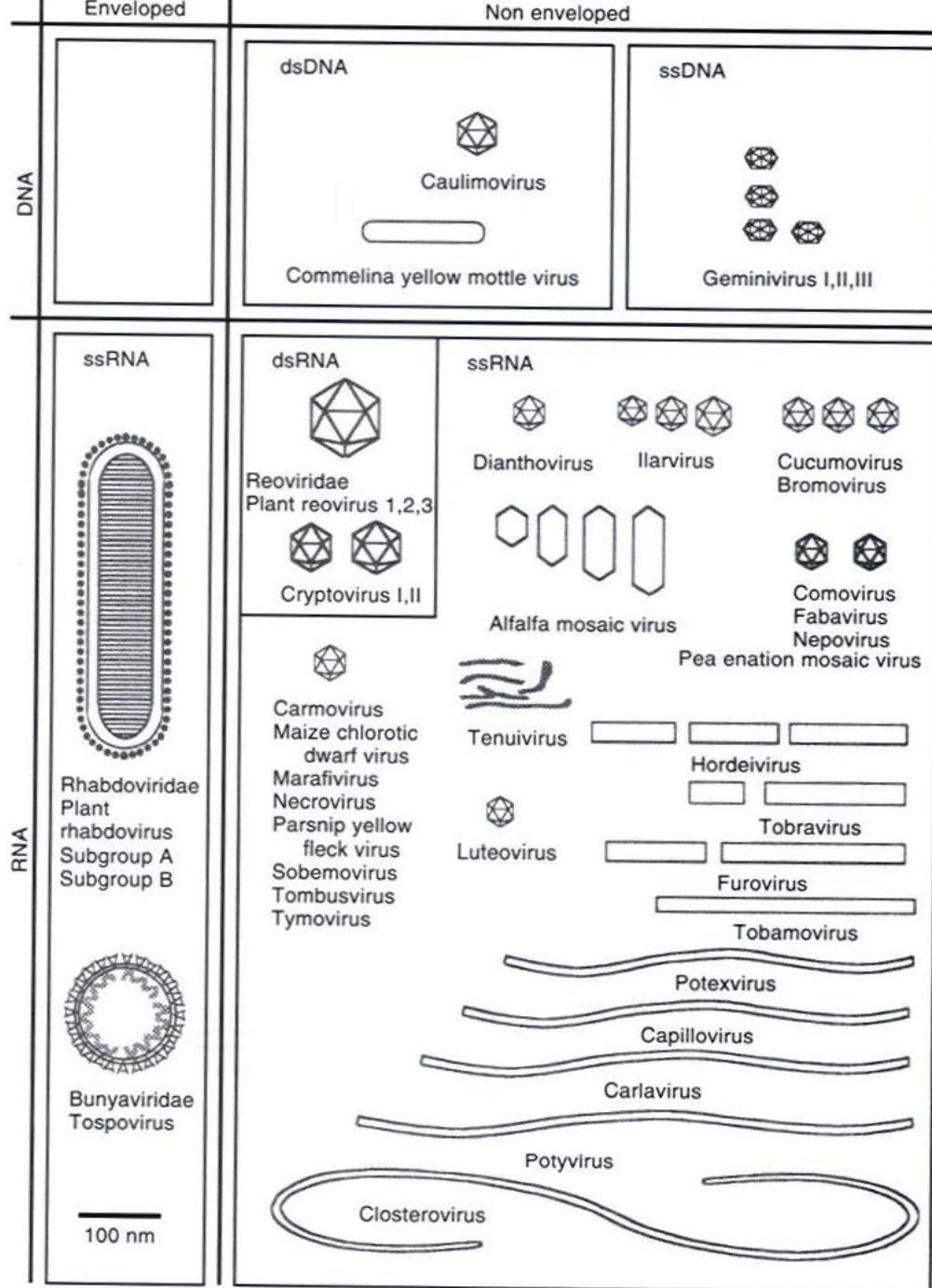


Levy, J. A., Fraenkel-Conrat, H. and Owens, R. A. (1994). "Virology". 3rd edition. Prentice-Hall, Inc.

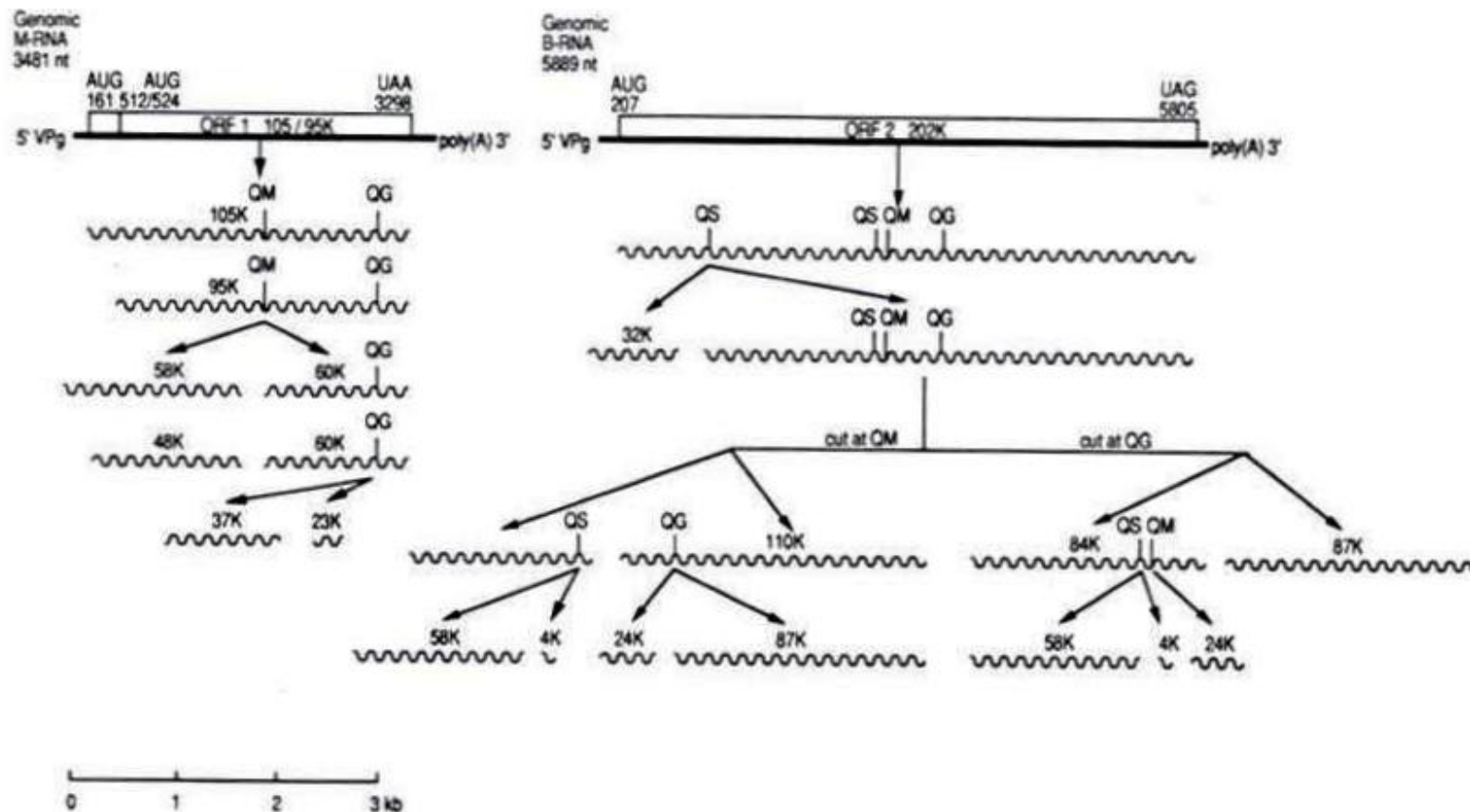


Protein functions :- 69K , ? cell to cell movement ; 150K and 70K RNA replication ; 20K , coat protein.

Figure 7.16 Organization and expression of a *Tymovirus* genome (TYMV, European strain).



Levy, J. A., Fraenkel-Conrat, H. and Owens, R. A. (1994). "Virology". 3rd edition. Prentice-Hall, Inc.



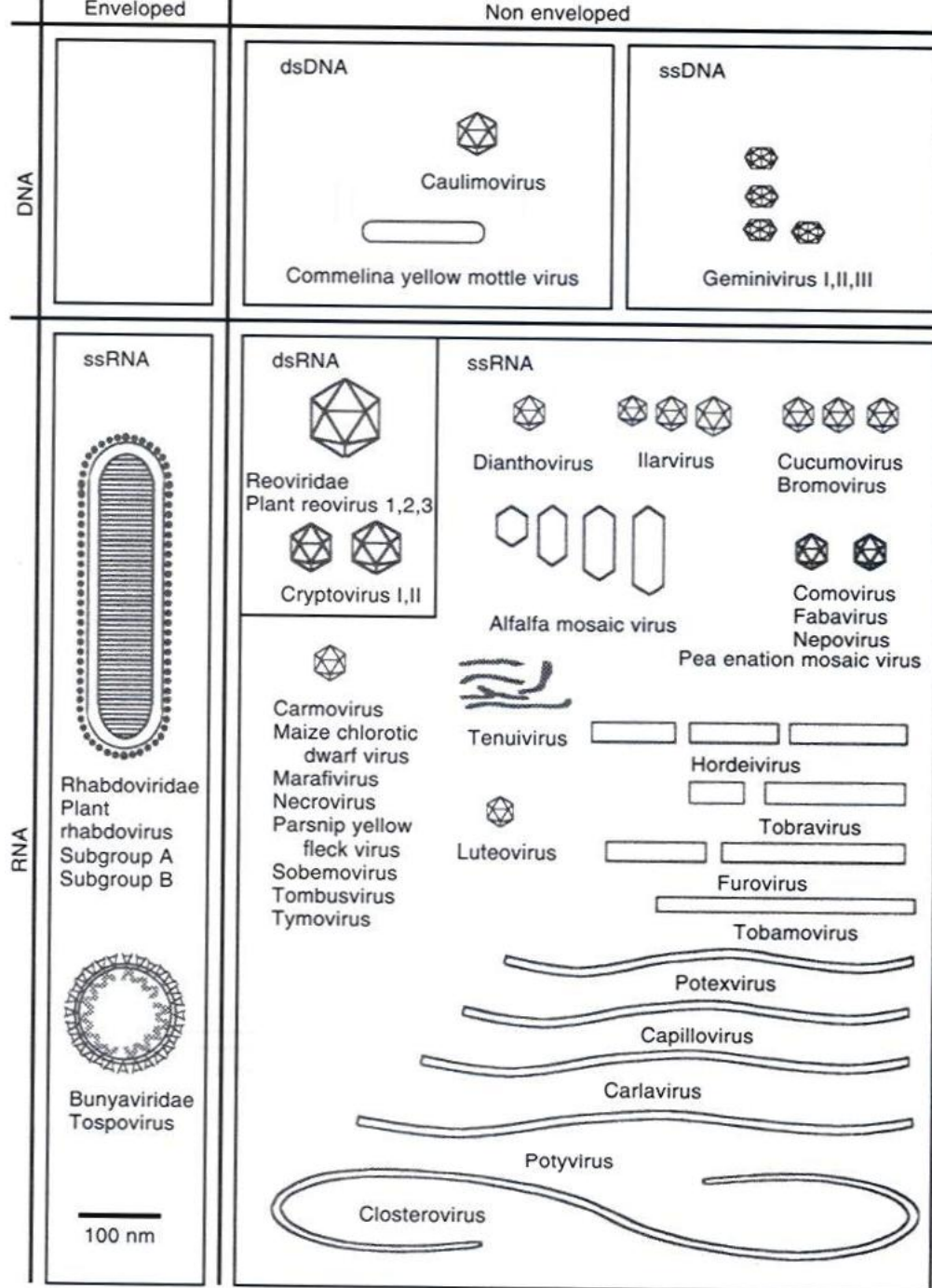
Proteinase cleavage sites Q-S = gln-ser ; Q-G = gln-gly ; Q-M = gln-met

Protein functions :- M encoded , 58K and 48K , cell-to-cell movement ; 37K and 23K , coat proteins

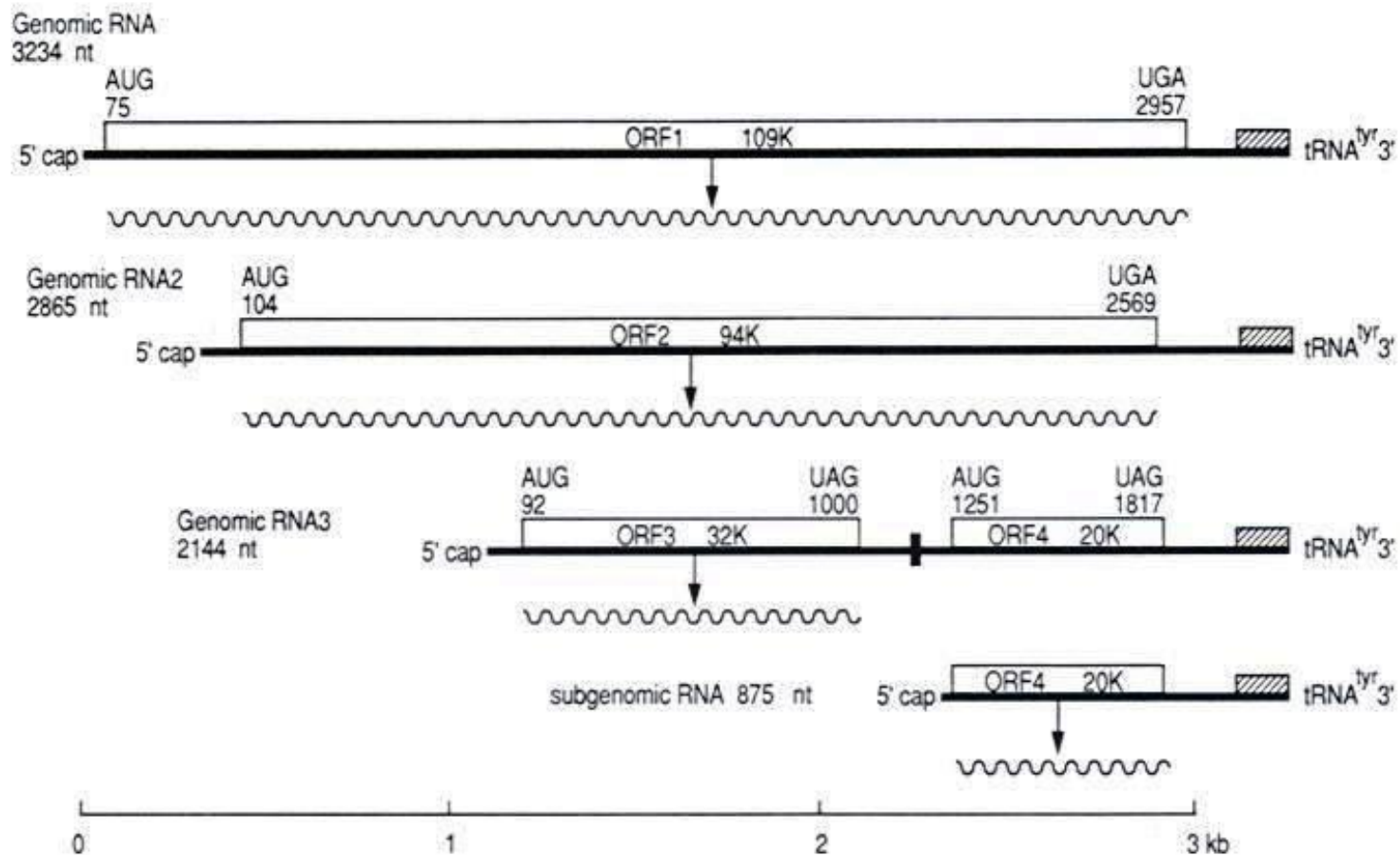
B encoded , 32K , Modulation of protease ; 4K , VPg ; 24K , protease ; 58K , RNA replication complex ; 110K replicase

Figure 7.23 Organization and expression of a *Comovirus* genome (CPMV).

Matthews, R. E. F. (1991).
"Plant Virology". 3rd edition.
Academic Press, Inc.



Levy, J. A., Fraenkel-Conrat, H. and Owens, R. A. (1994). "Virology". 3rd edition. Prentice-Hall, Inc.



Protein functions :- 109K and 94K , RNA replication ; 32K , cell to cell movement ? ; 20K , coat protein.

▨ = 3' terminal homologous regions ■ = oligoA in RNA3

Figure 7.26 Organization and expression of a *Bromovirus* genome (BMV).

Matthews, R. E. F. (1991).
"Plant Virology". 3rd edition.
Academic Press, Inc.

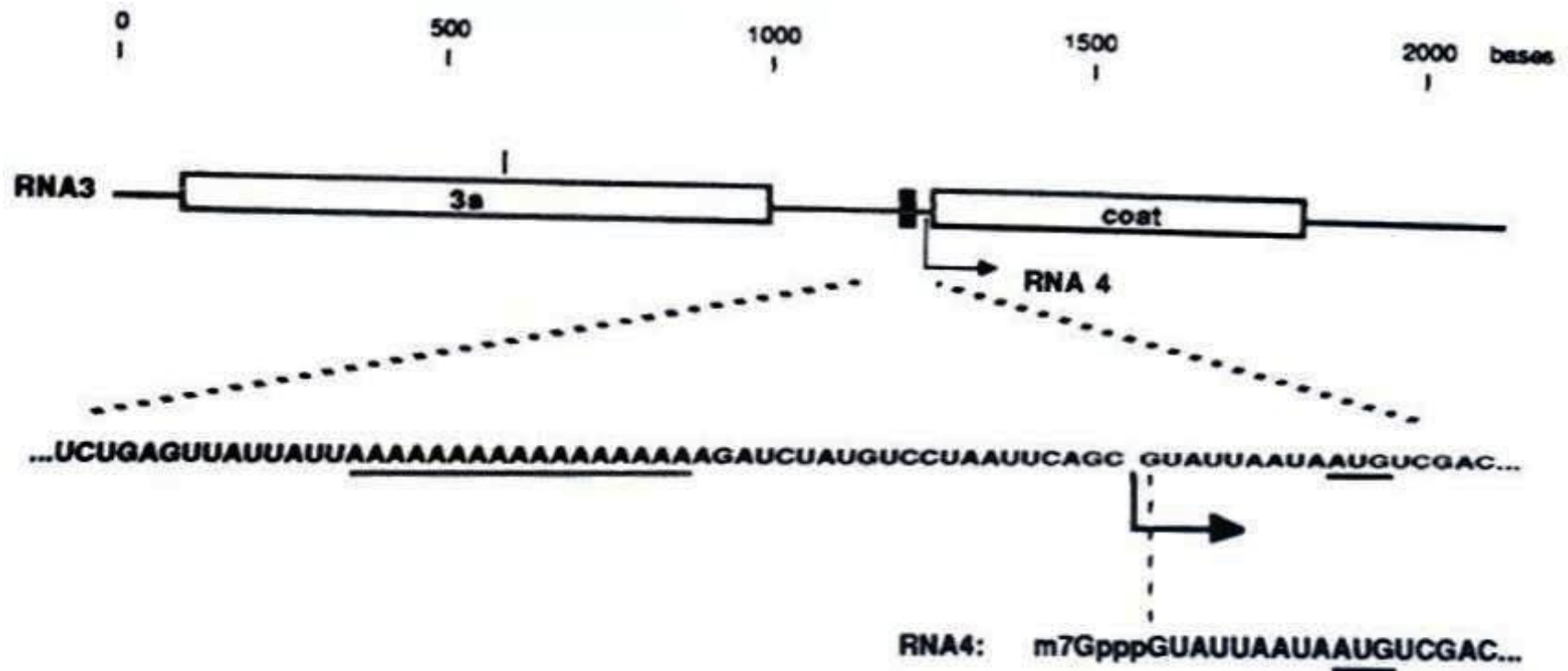
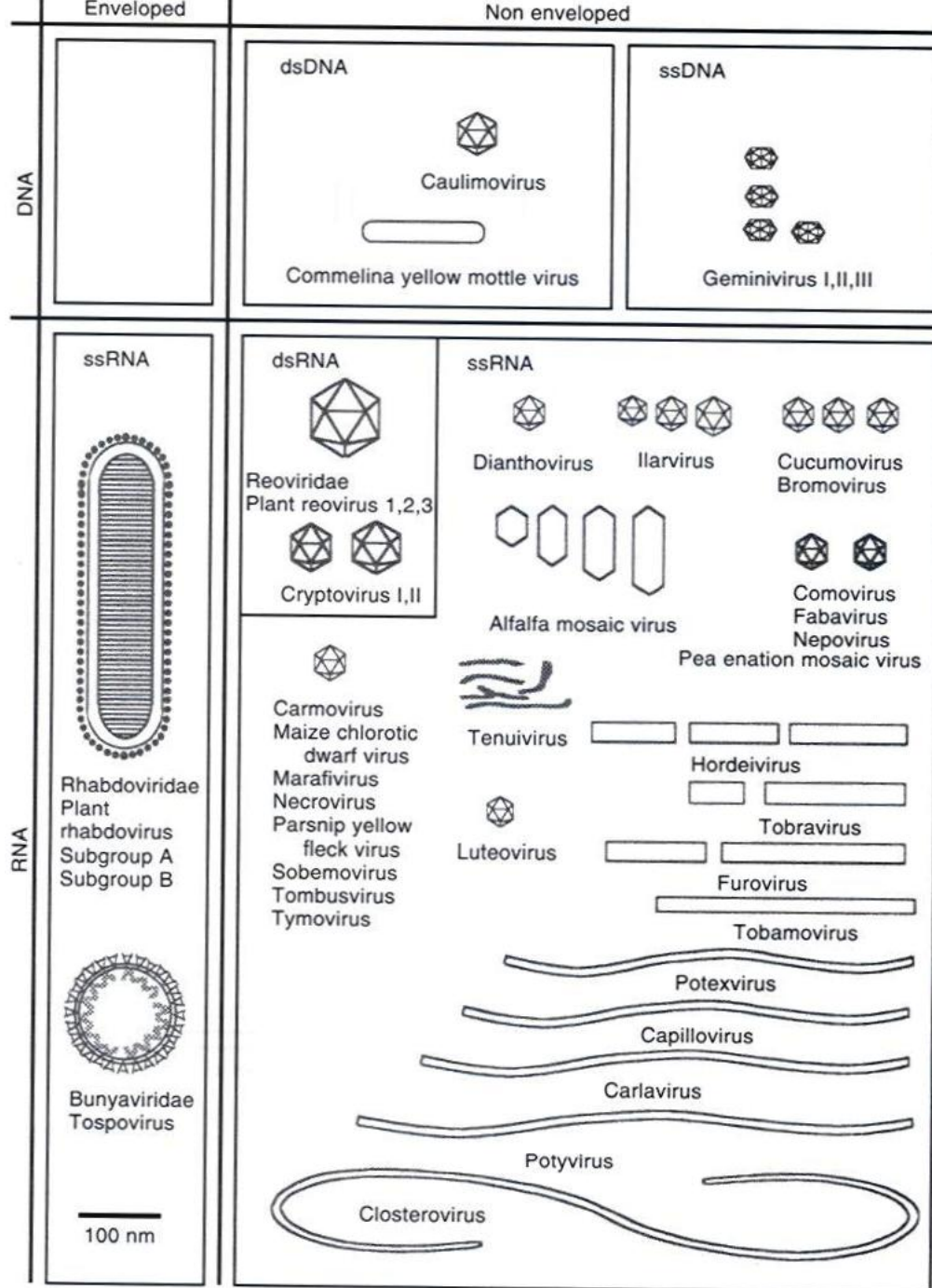
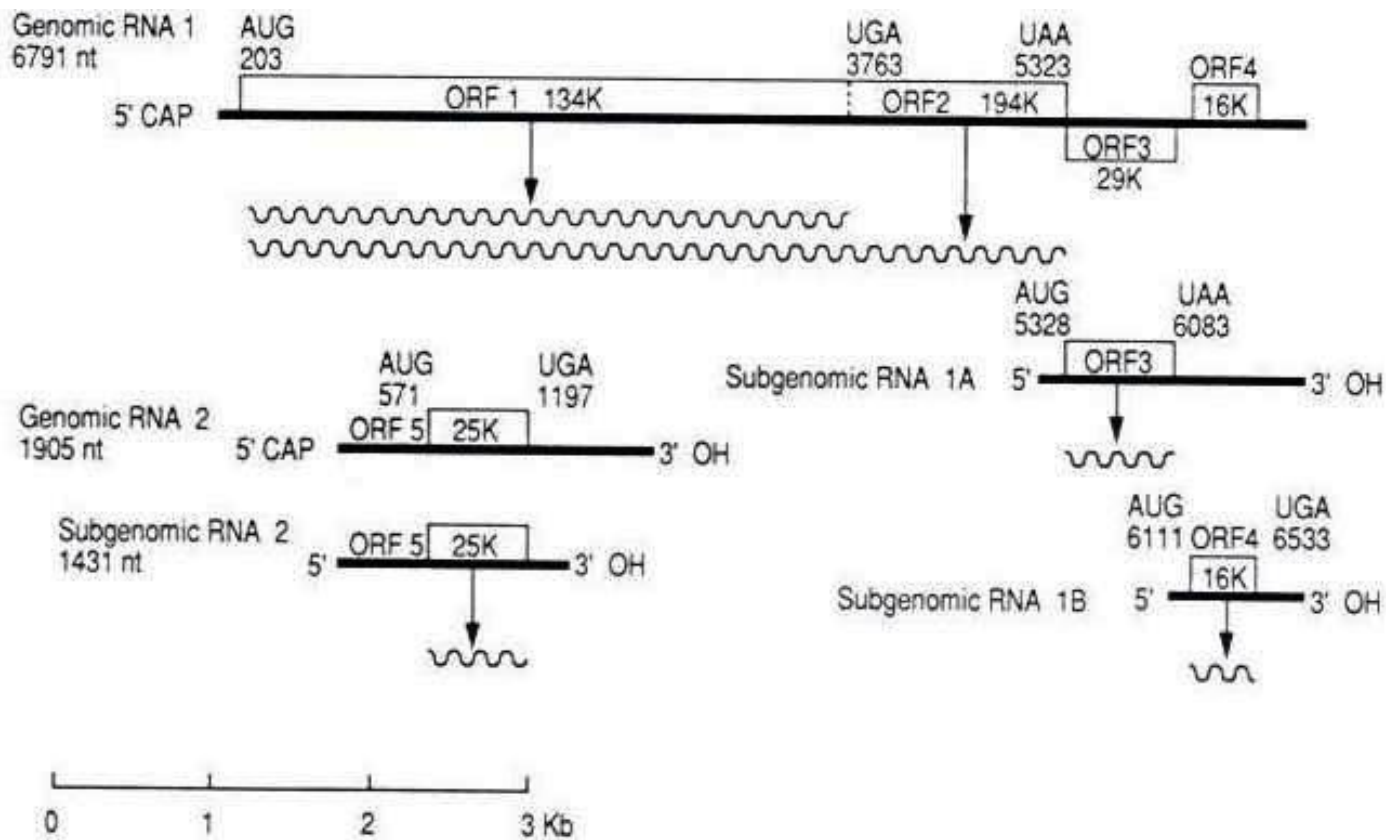


Figure 6.14 The internal promoter for BMV subgenomic RNA4 synthesis situated in RNA3. In the schematic map of RNA3, coding regions are shown as boxes and noncoding regions as lines. The nucleotide sequence of the intercistronic promoter region is shown, and below that the 5' terminal sequence of RNA4, which overlaps with the 3' region of the promoter. The coat protein AUG initiation site is underlined. The positive sense sequence packaged in virus particles is shown. The actual promoter sequence for RNA4 plus strand synthesis is complementary to this sequence. (From French and Ahlquist, 1988.)



Levy, J. A., Fraenkel-Conrat, H. and Owens, R. A. (1994). "Virology". 3rd edition. Prentice-Hall, Inc.



Protein functions :- RNA 1 134K, ? ; 194K, polymerase ; 29K, cell to cell transport ; 16K, ?
 RNA 2 25K, coat protein.

Figure 7.32 Organization and expression of a *Tobravirus* genome (TRV) (RNA1 = strain SYM; RNA2 = strain PSG).

Summary of Genome Strategies Adopted by 18 Single-Stranded Positive Sense RNA Plant Virus Groups

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			<i>Tombusvirus</i>	5	5
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			<i>Cucumovirus</i>	4	4
			Alfalfa mosaic virus	4	4
			<i>Ilarvirus</i>	4	4
			<i>Hordeivirus</i>	7	7
VII	Three strategies	Subgenomic RNAs, multipartite genome, and read-through protein (or frameshift)	<i>Tobravirus</i>	5	5
			<i>Furovirus</i>	9	6-9
			<i>Dianthovirus</i>	4	4

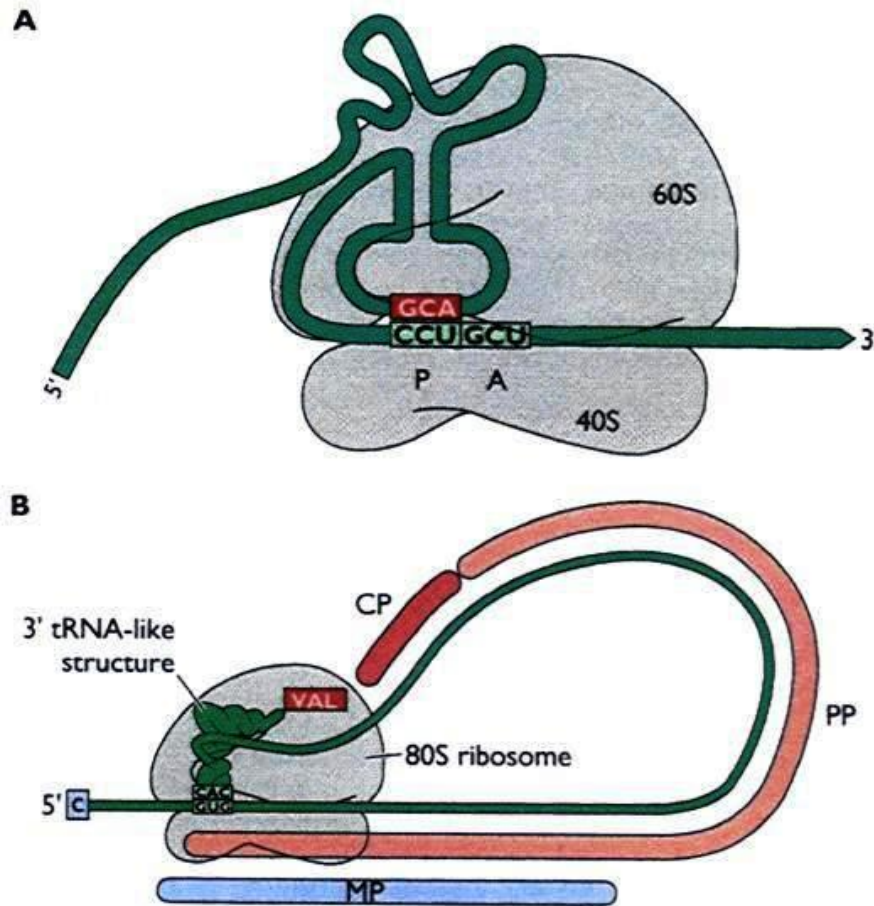


Figure 11.4 Two mechanisms of methionine-independent initiation. (A) The viral mRNA of picornavirus-like viruses of insects mimics the structure of tRNA, which occupies the P site of the ribosome, allowing initiation to take place within the A site. Adapted from M. Bushell and P. Sarnow, *J. Cell Biol.* **158**:395–399, 2002, with permission. (B) A tRNA-like structure in the 3′ untranslated region of turnip yellow mosaic virus RNA occupies the P site of the ribosome. The tRNA-like structure is aminoacylated with valine, which is incorporated as the first amino acid of the viral polyprotein. Adapted from S. Barends et al., *Cell* **112**: 123–129, 2003, with permission.

Flint, S. J., Enquist, L. W., Krug, R. M., Racaniello, V. R. and Skalka, A. M. (2004). "Principles of Virology. Molecular Biology, Pathogenesis, and Control". 2nd edition. ASM Press.