

- **Viral Genomes-- DNA**

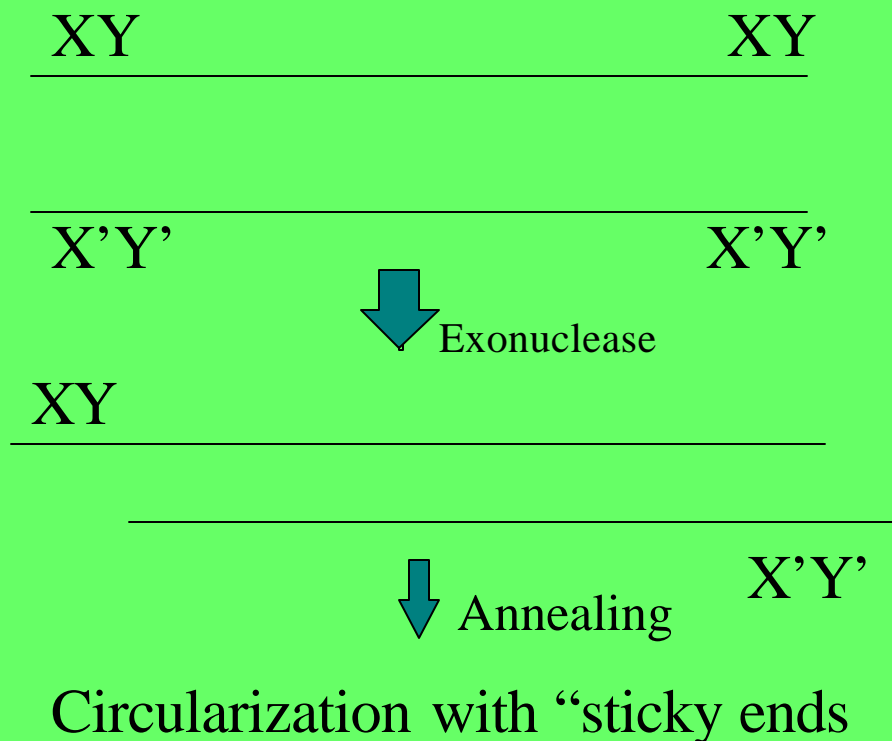
- **Linear or Circular**

- **May stay as linear or circular throughout life cycle or move from circular → linear → circular**
 - **Circular and linear DNAs can be distinguished by reactivity to exonuclease sensitivity**
 - **Most DNAs are dsDNA**

• Unusual Features of Viral DNA Genomes

– Terminal Redundancy (direct repeats)

- In Herpes virus' the DNA is linear
- There are direct repeats at either end of genome
- Redundancy is small (~500bp) and does not occur within genes



- Terminal Redundancy (inverted repeats)
 - Adenovirus DNA with exonuclease does not allow the formation of dsDNA circles (ss termini exposed by exonuclease treatment cannot base pair)
 - **When denatured by alkali, and then neutralized, both of the DNA strands are capable of forming ssCircles**
 - **These are formed by interaction of the 3' and 5' ends of the same strand– meaning that there must be an inverted repeat on the ends of these strands**

XY

Y'X'

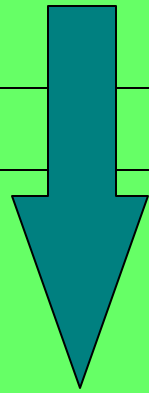
X'Y'

YX



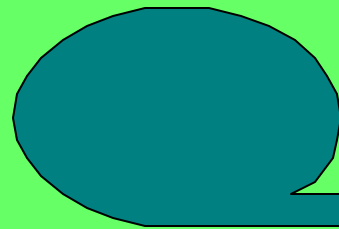
~~Exonuclease~~///Denature/Reannealing

~~XY~~



YX

From ssDNA strand



Y'X'

YX

- **Circular Permutation**

- Phage T4 genome is a linear DNA molecule but its genetic map is circular
- This occurs because the genome is “circularly permuted”
- DNA is produced as a long **CONCATEMER** of genomes arranged in a head-to-tail array
 - Genome length molecules are cleaved from this concatemer (non-specific) and some genes may be present 2X
 - This may be different for each individual virus with different genes in each individual depending upon where cleavage occurred and which genes are repeated 2X
 - **Result:** if DNA from phage is denatured and then annealed, circles are formed resulting from the pairing of complementary strands from different molecules with

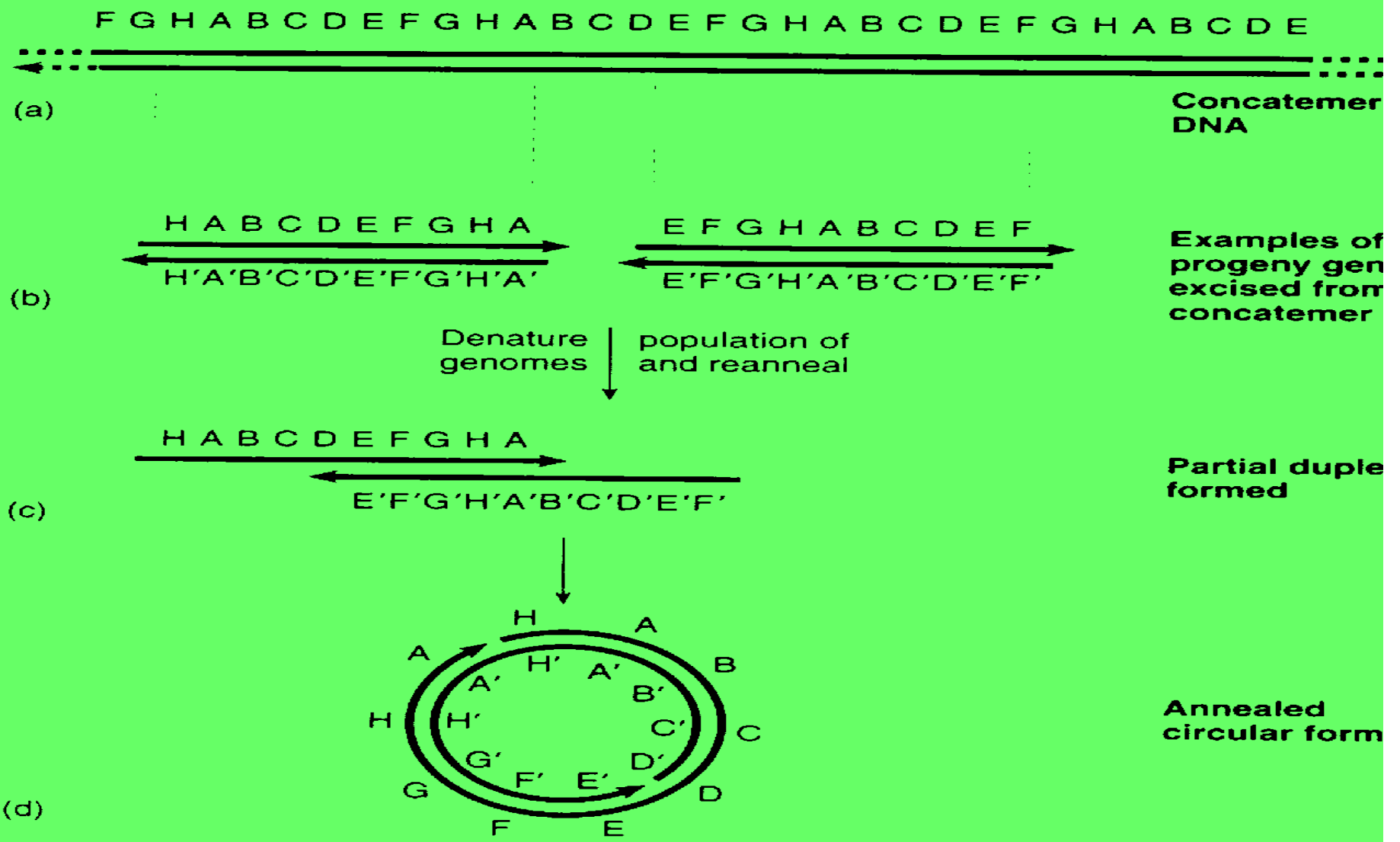


Fig. 4.6 Demonstration of circular permutation in phage T4. (a) Replication produces concatemeric DNA. (b) Genome length molecules are cleaved sequence non-specifically from the concatemer. The genome length is greater than the length of one set of genes. (c, d) A population of genome molecules, if denatured and allowed to reanneal, will form a variety of partial duplexes which can circularize. Different genes are indicated A, B, etc. and their sequence complements as A', B', etc.

• Unusual Features of RNA Genomes

– Segmented genomes

- Reovirus- dsRNA in 10 segments
 - Show no base homology and each segment is unique
- Orthomyxoviruses- negative-sense ssRNA

– Satellite Viruses

- Cannot replicate without help from another virus

– Viroids

- Agents of disease in plants
- ssRNA with NO protein component
- Disease results from RNA interfering with essential host mechanisms???

– Terminal Caps (methylation)

– Overlapping genes