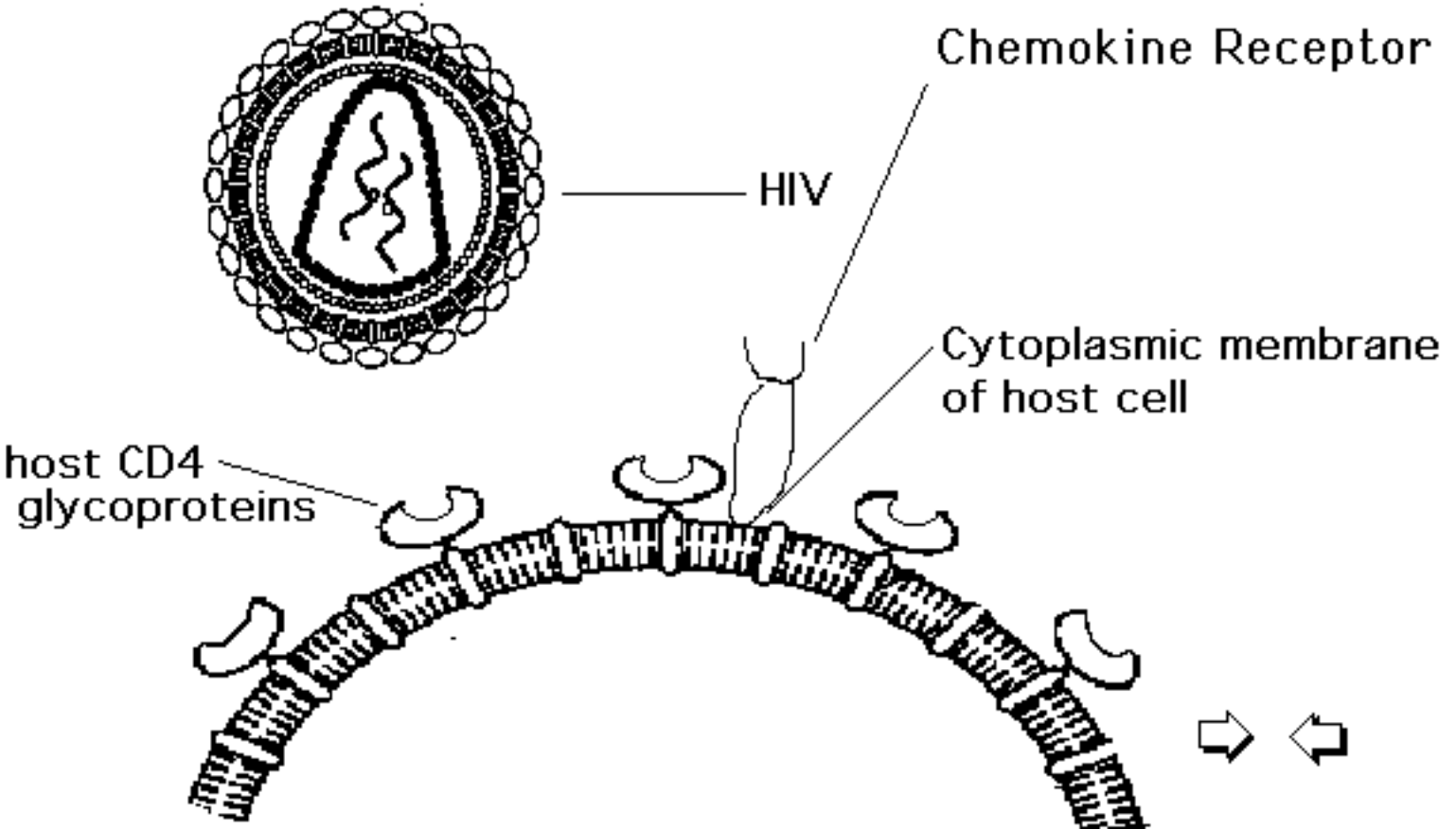
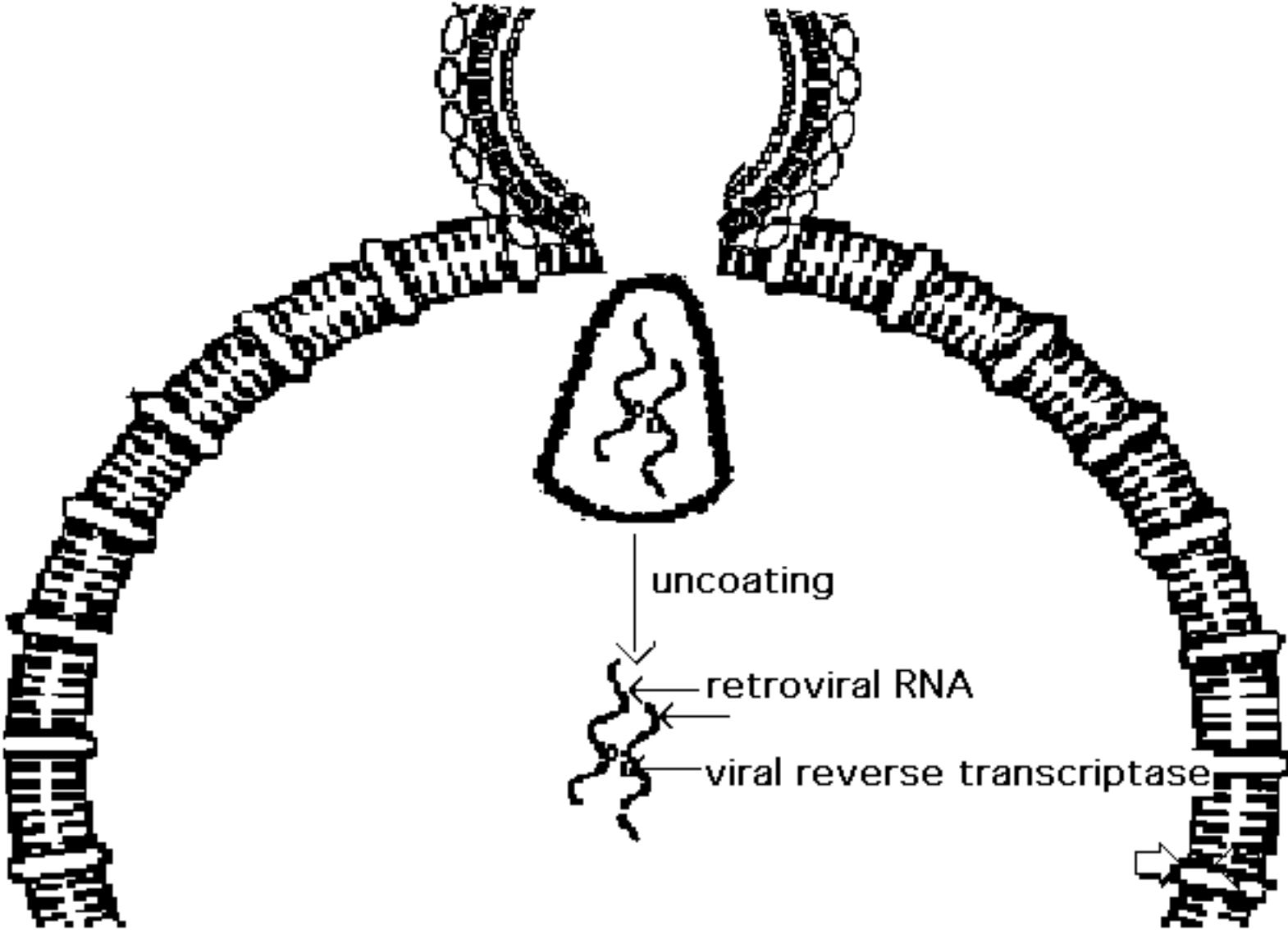
INFECTION OF HOST CELL BY HIV



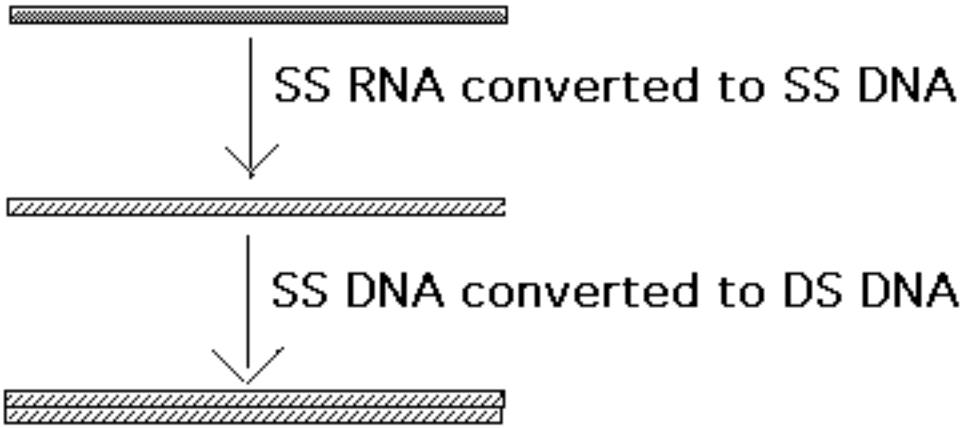
Step 1. Adsorption of virus to host cell:
Gp 120 molecules on envelope of virion bind to CD4 glycoproteins on host cell membrane

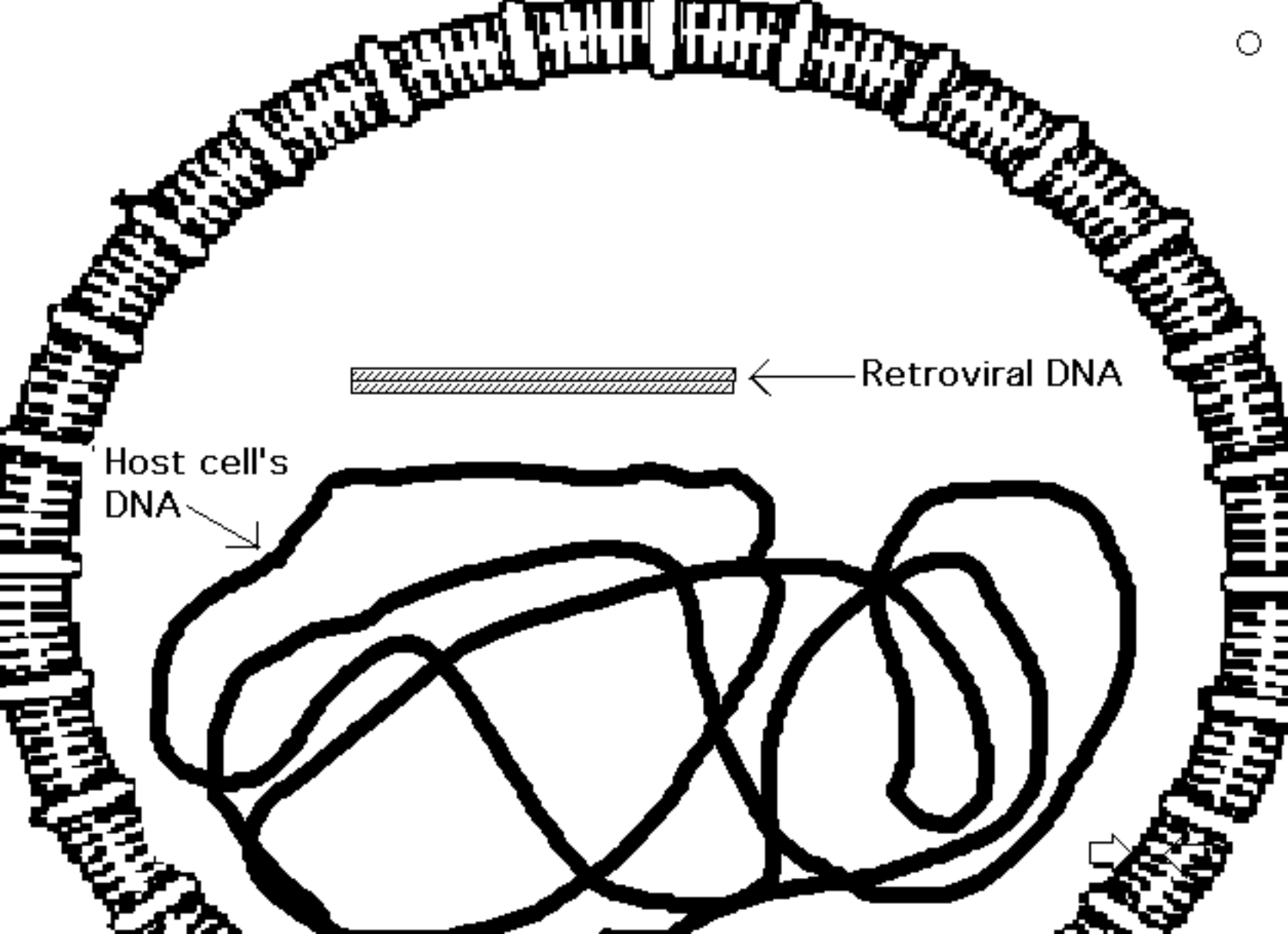
Step 2. Penetration:
Viral nucleocapsid enters host cell

Step 3. Uncoating: Nucleic acid is released from capsid

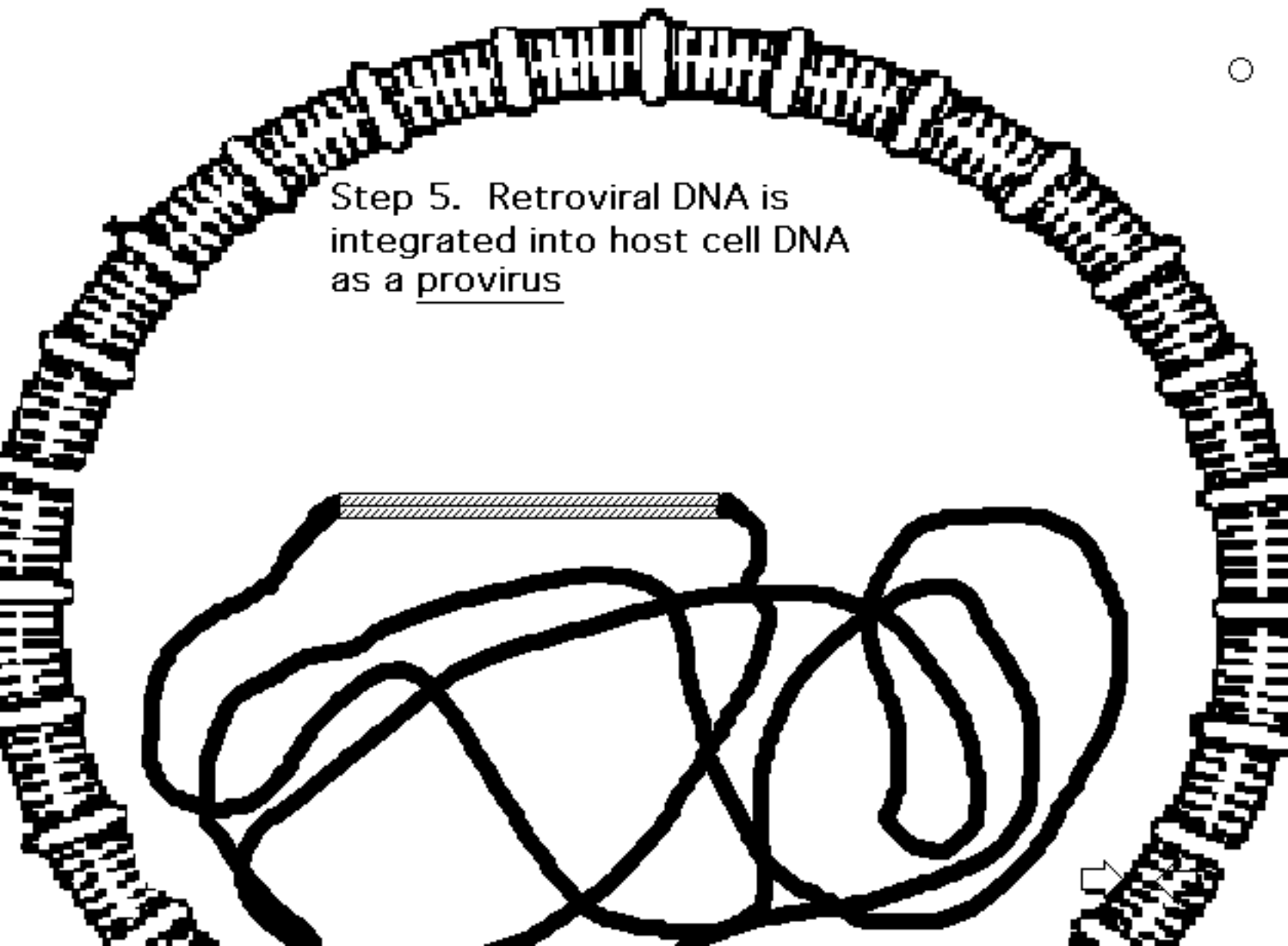


Step 4. Reverse transcription
Viral RNA is transcribed into DNA, using viral enzyme.

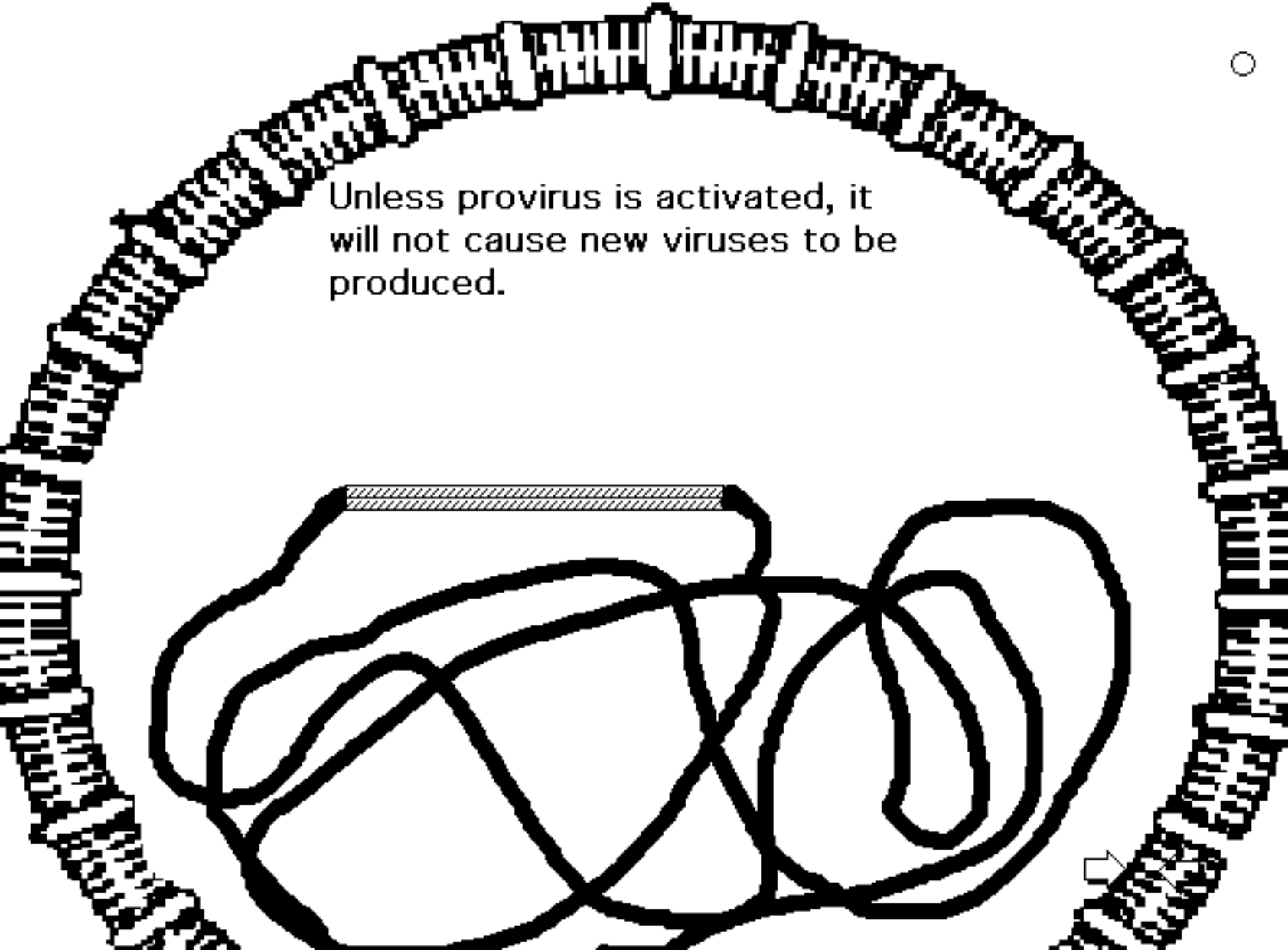


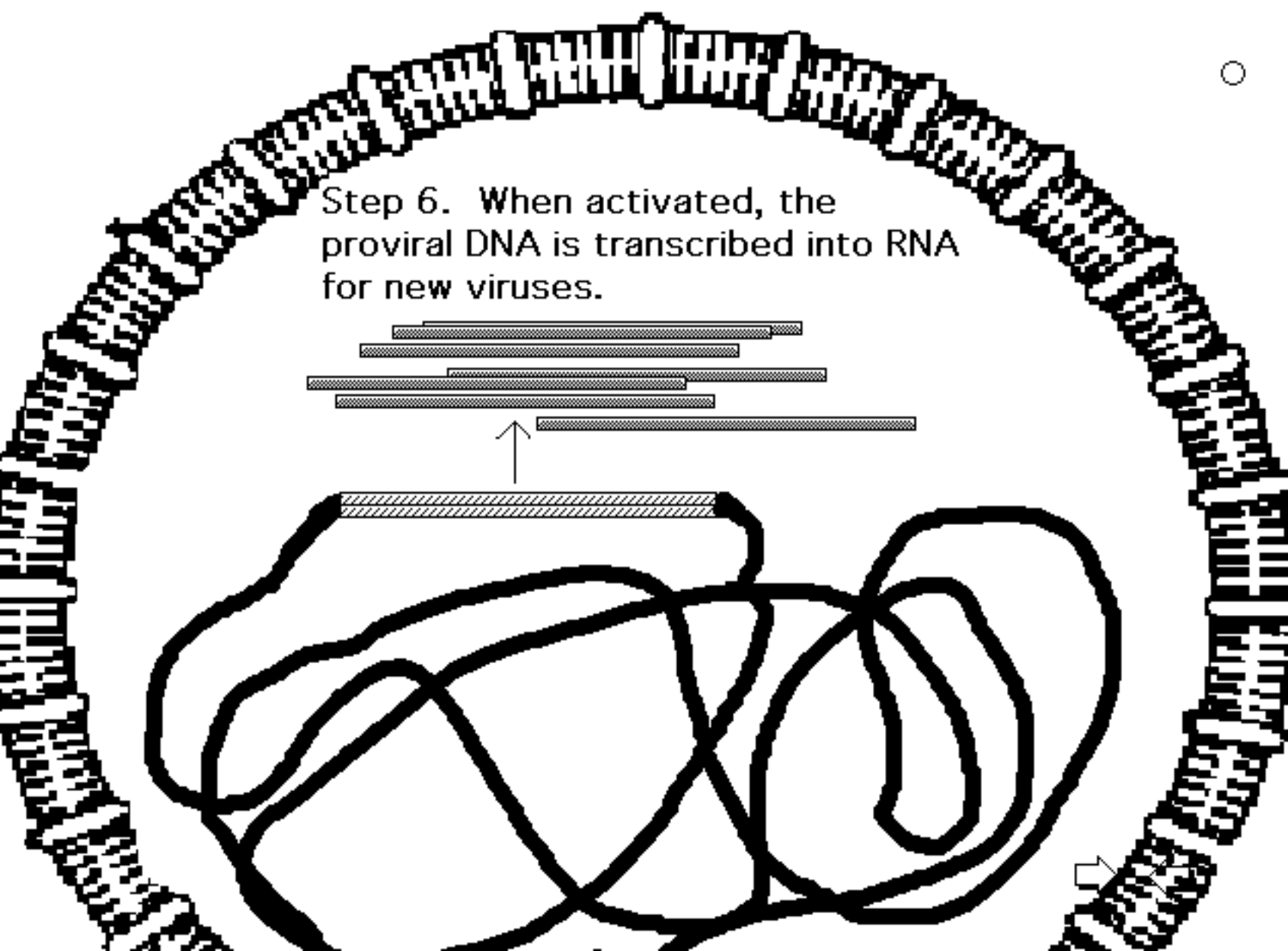

Retroviral DNA
Host cell's
DNA

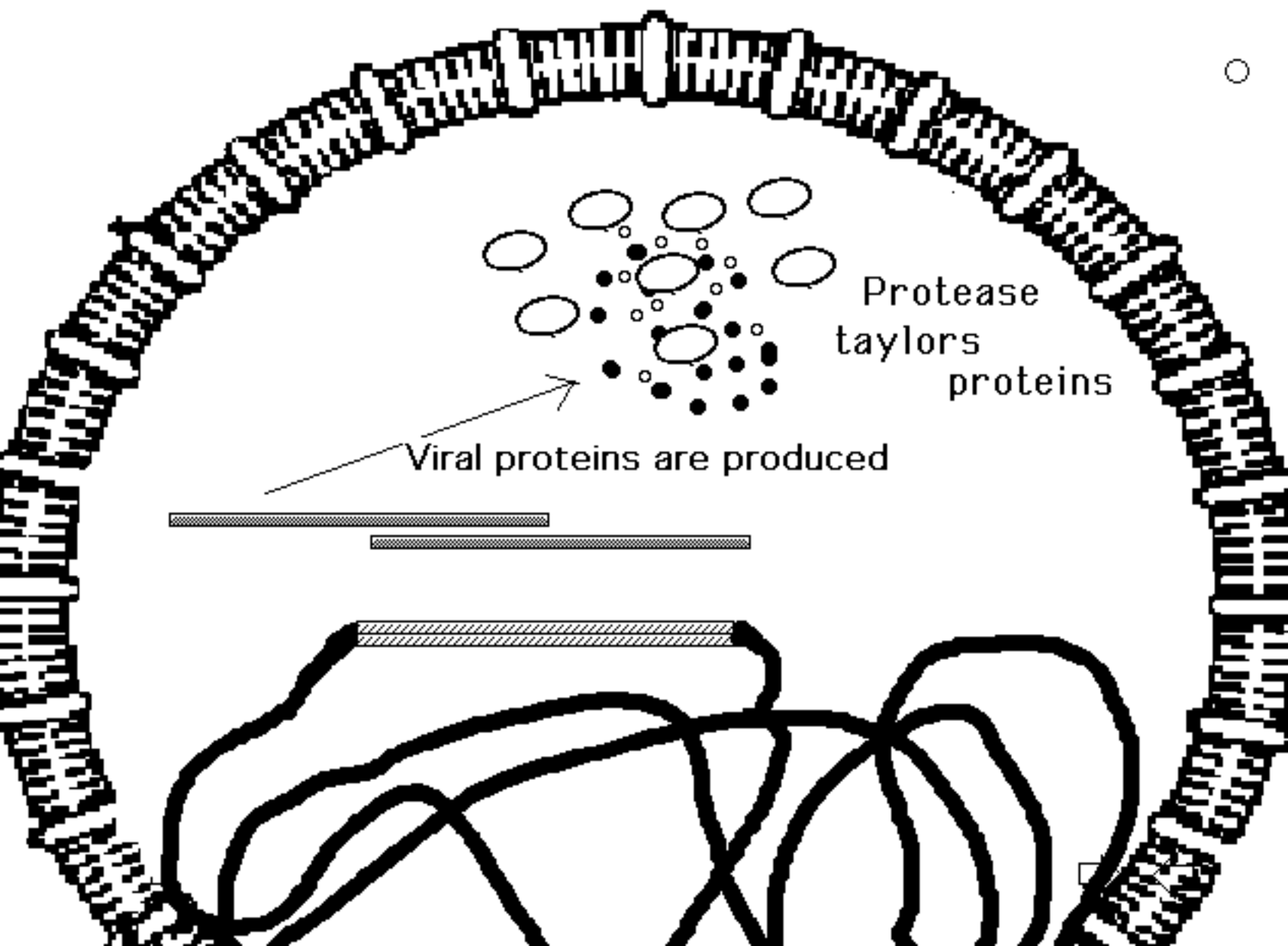
Step 5. Retroviral DNA is integrated into host cell DNA as a provirus

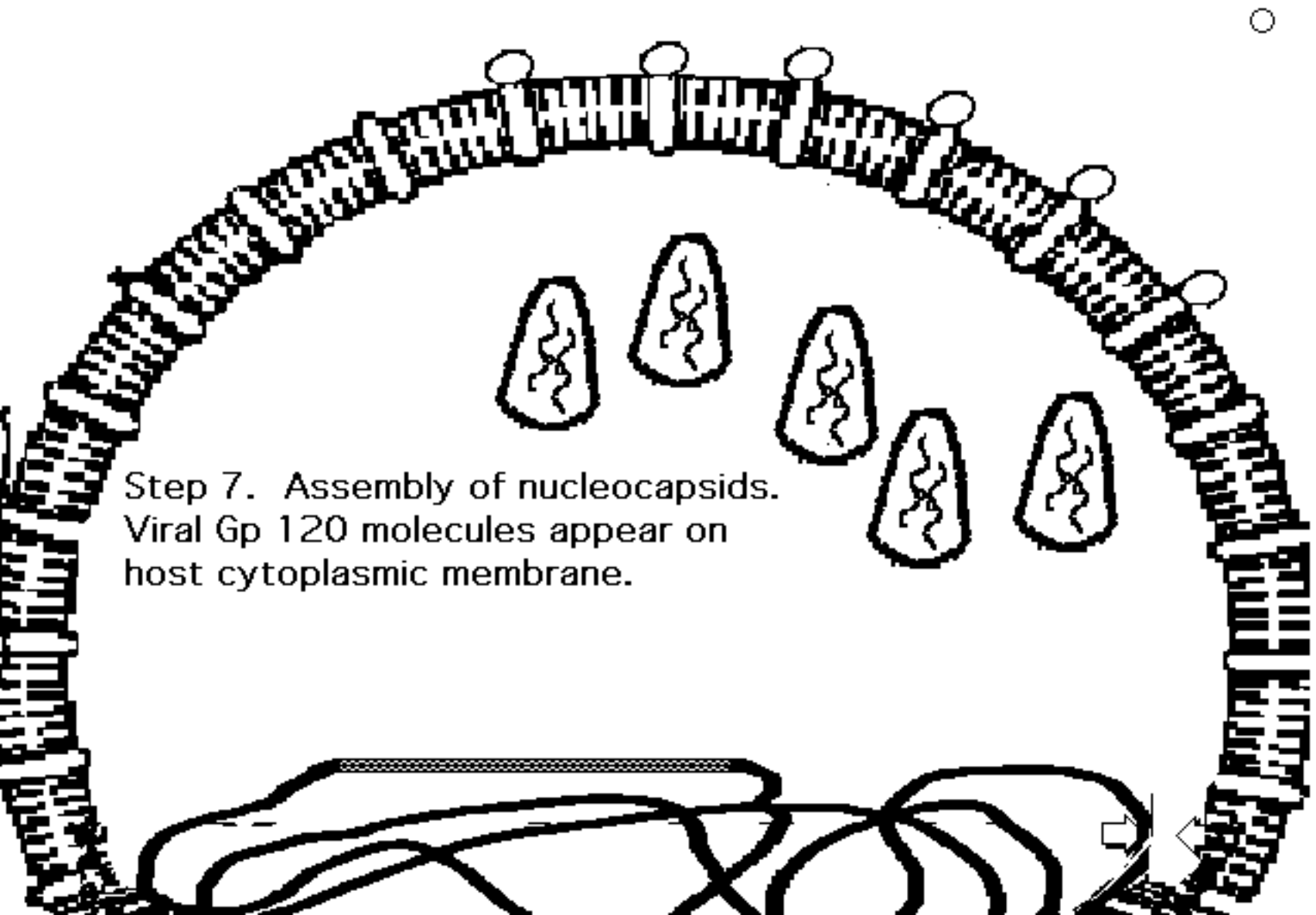


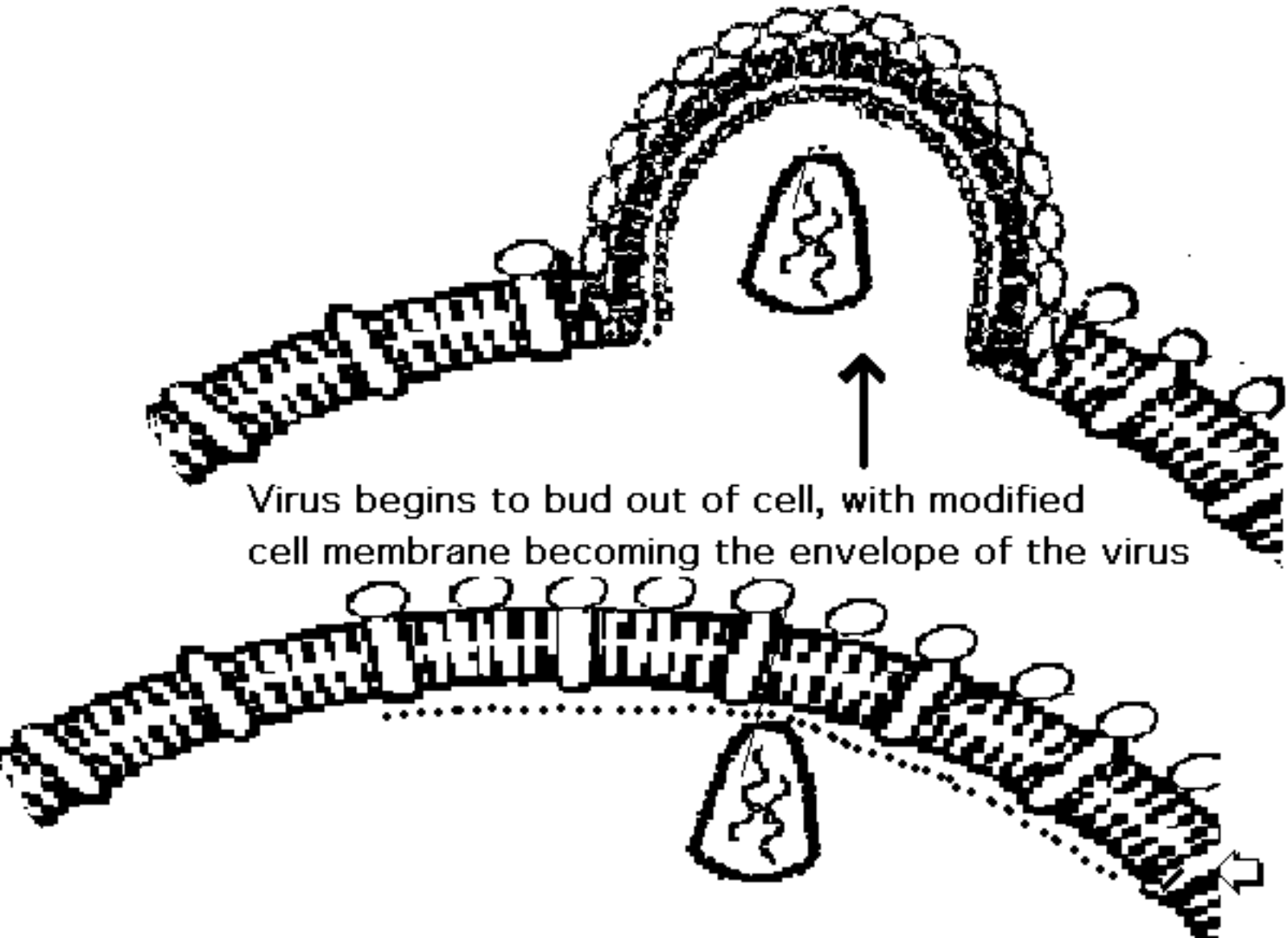
Unless provirus is activated, it will not cause new viruses to be produced.



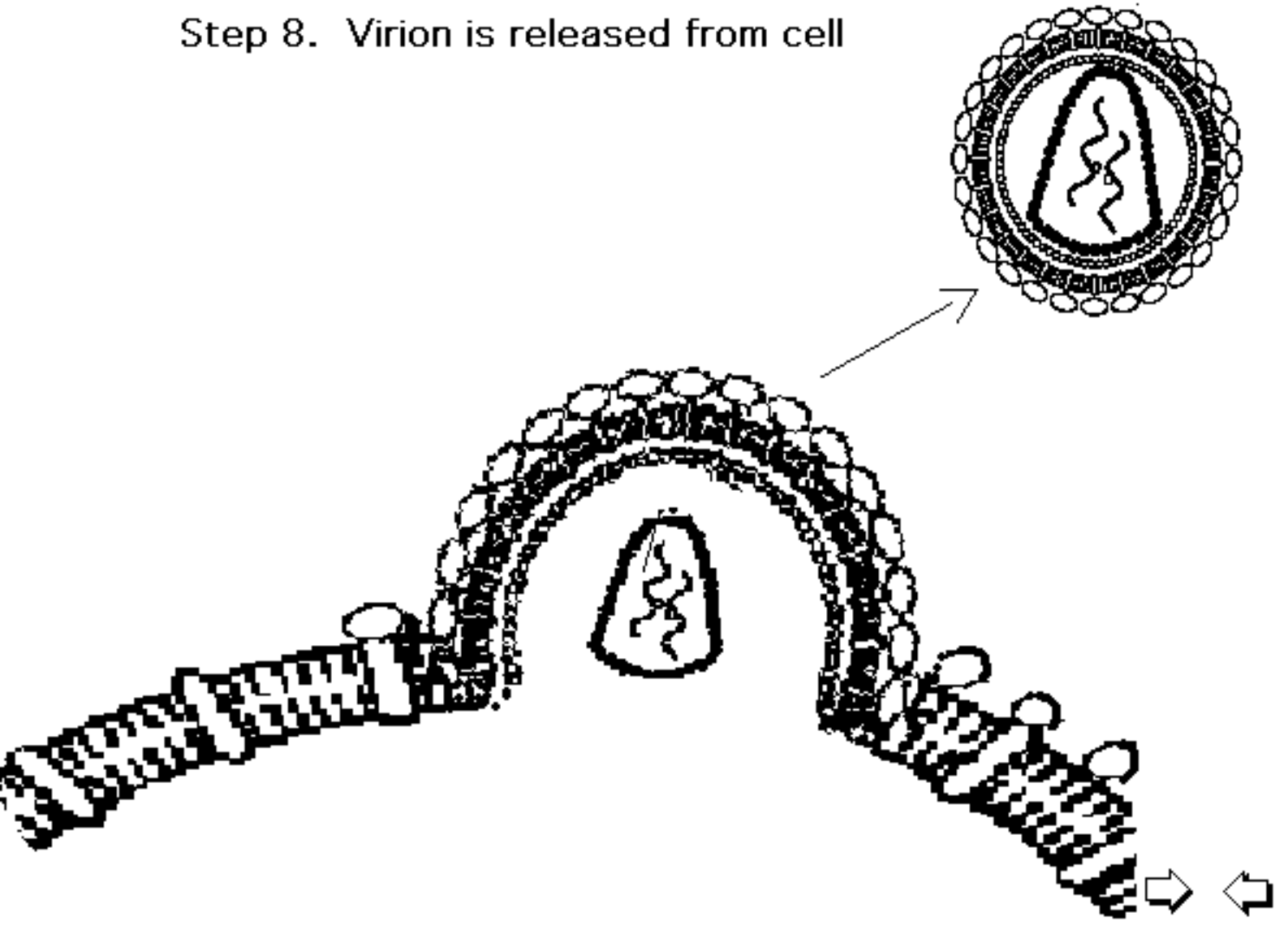

Step 6. When activated, the proviral DNA is transcribed into RNA for new viruses.

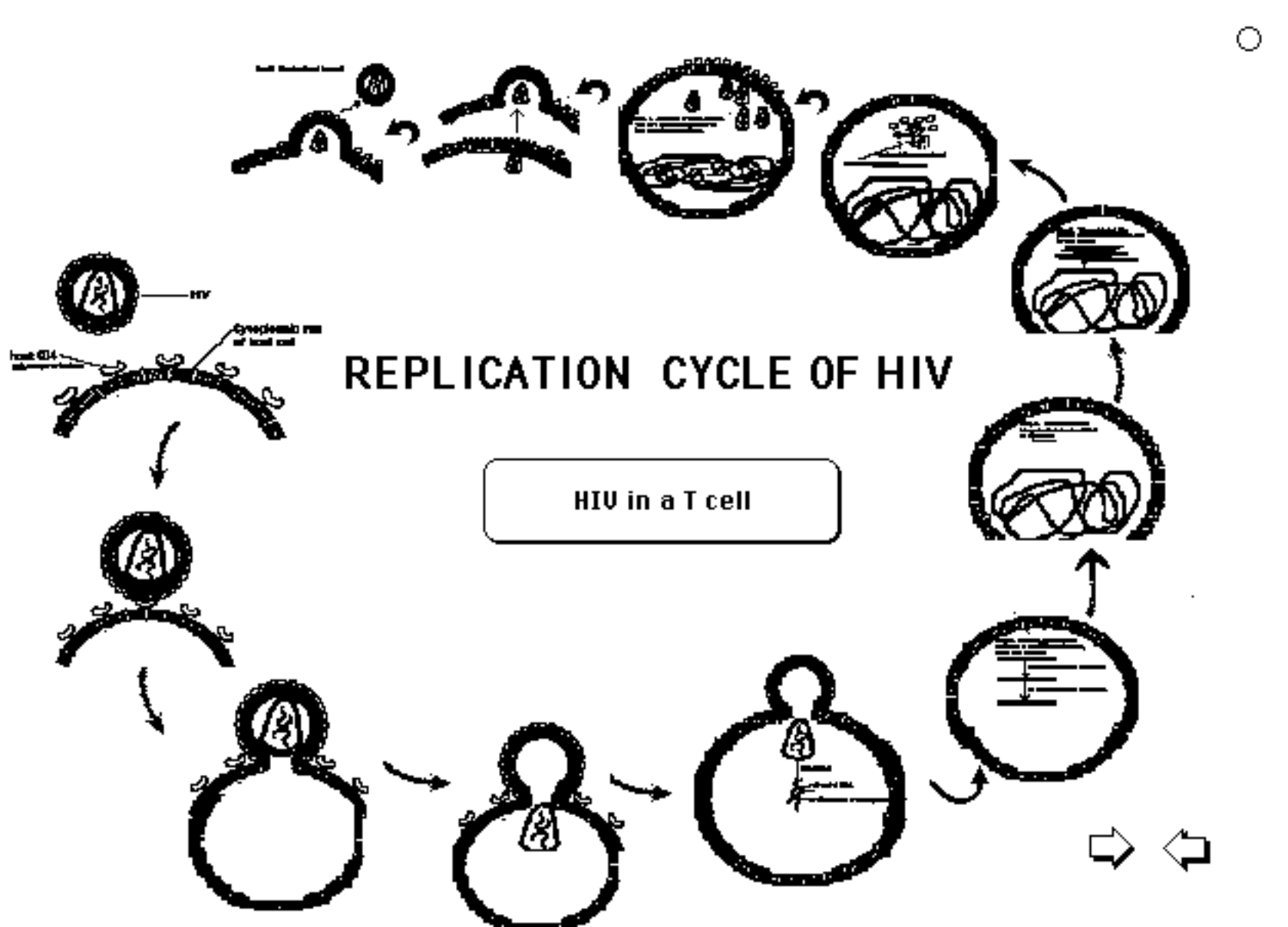

Protease
taylors
proteins
Viral proteins are produced


Step 7. Assembly of nucleocapsids.
Viral Gp 120 molecules appear on
host cytoplasmic membrane.


Virus begins to bud out of cell, with modified
cell membrane becoming the envelope of the virus

Step 8. Virion is released from cell




REPLICATION CYCLE OF HIV
HIV in a T cell

Attacking THE AIDS VIRUS:

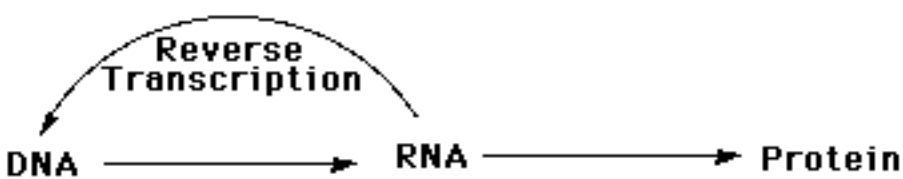
New Weapons against HIV

1. Block Binding of Virus to Cell
2. Reverse Transcriptase Inhibitors (AZT)
3. Protease Inhibitors (Indinavir)

The Virus Attacks

Attacking AIDS

Attacking AIDS-2



HIV Protein

Attacking THE AIDS VIRUS:

New Weapons against HIV

1. Block Binding of Virus to Cell
2. Reverse Transcriptase Inhibitors (AZT)
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The Virus Attacks

Attacking AIDS

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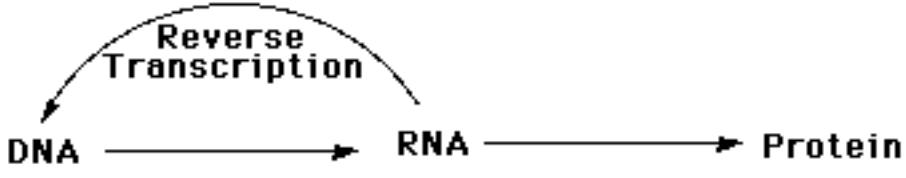
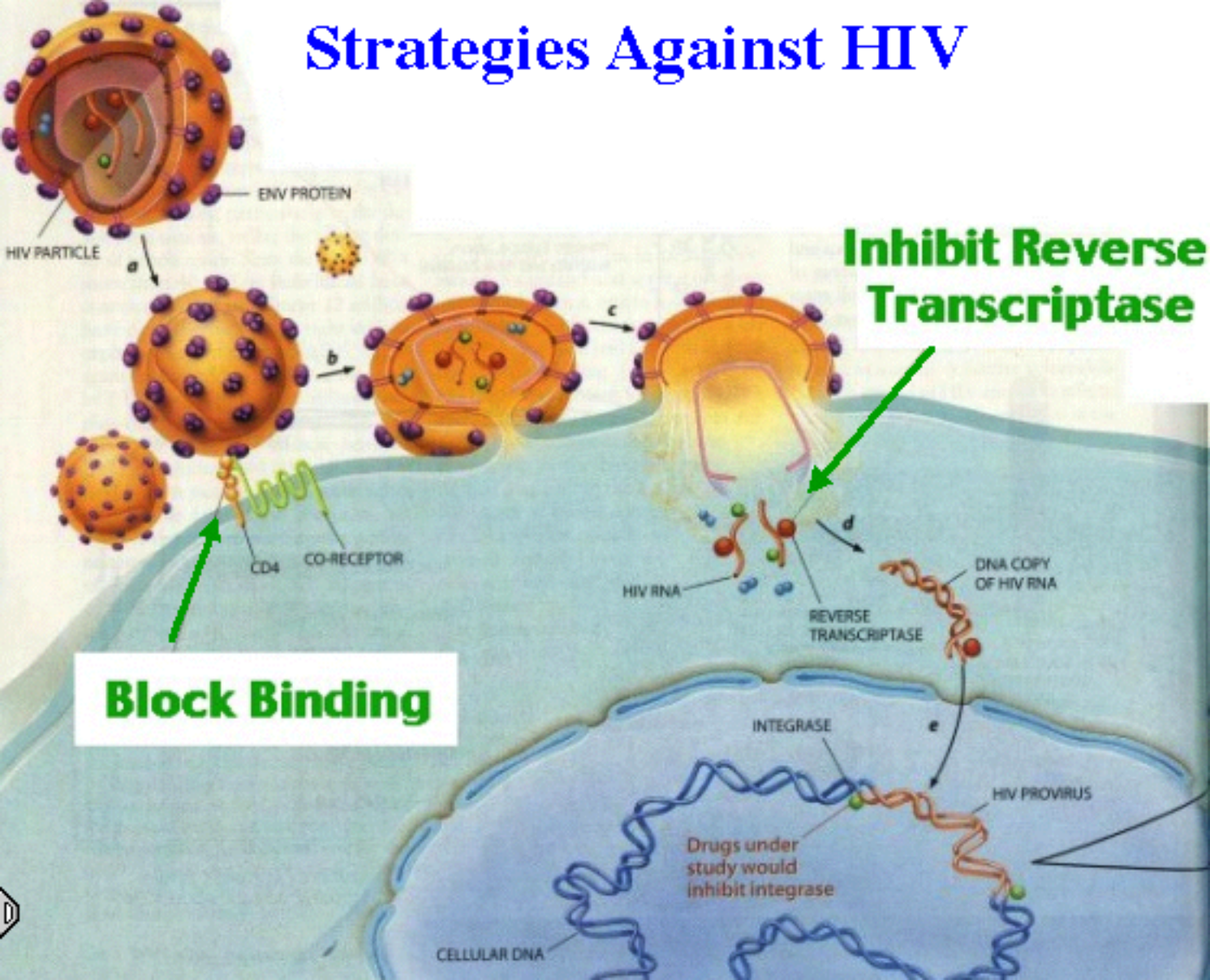
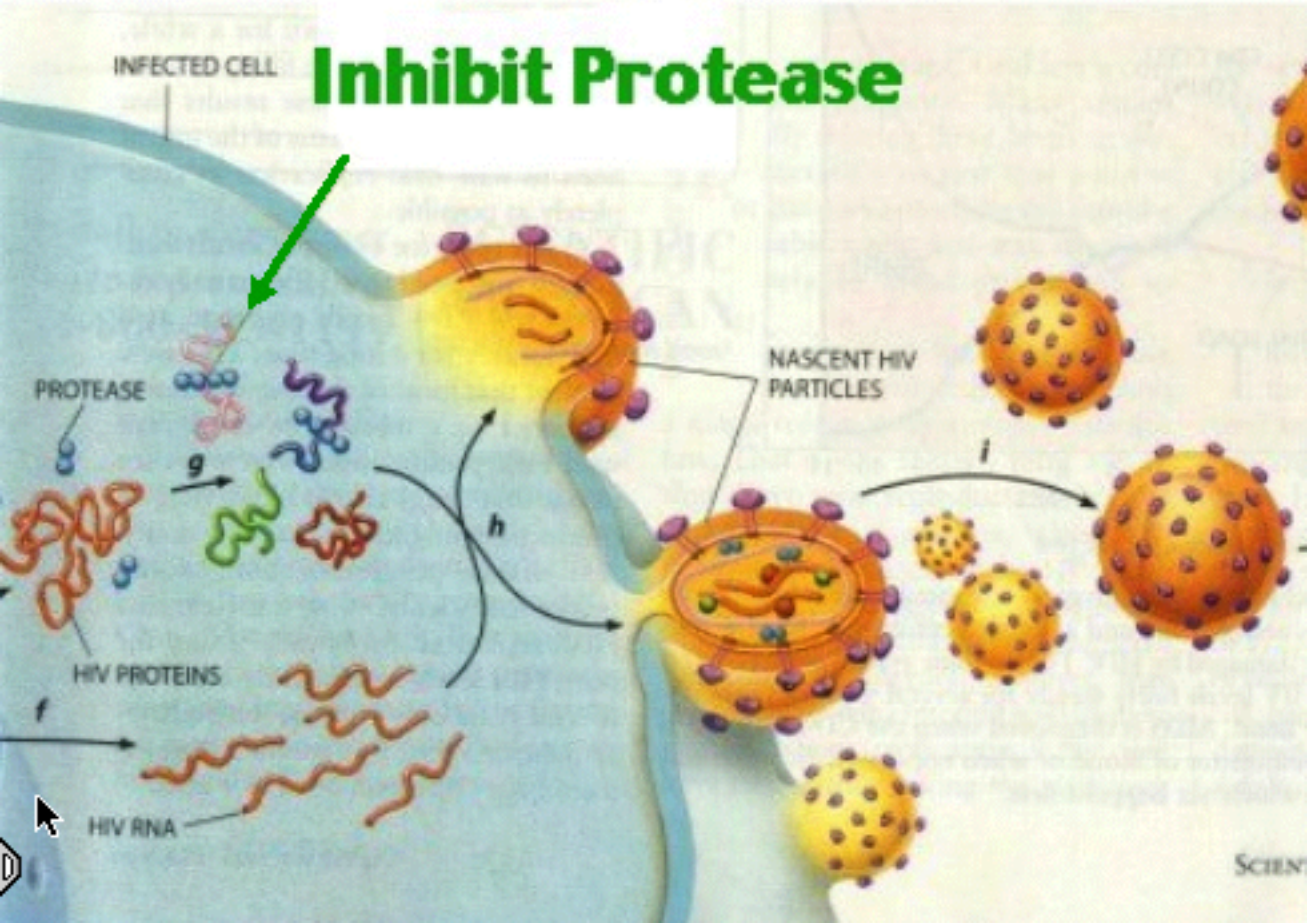


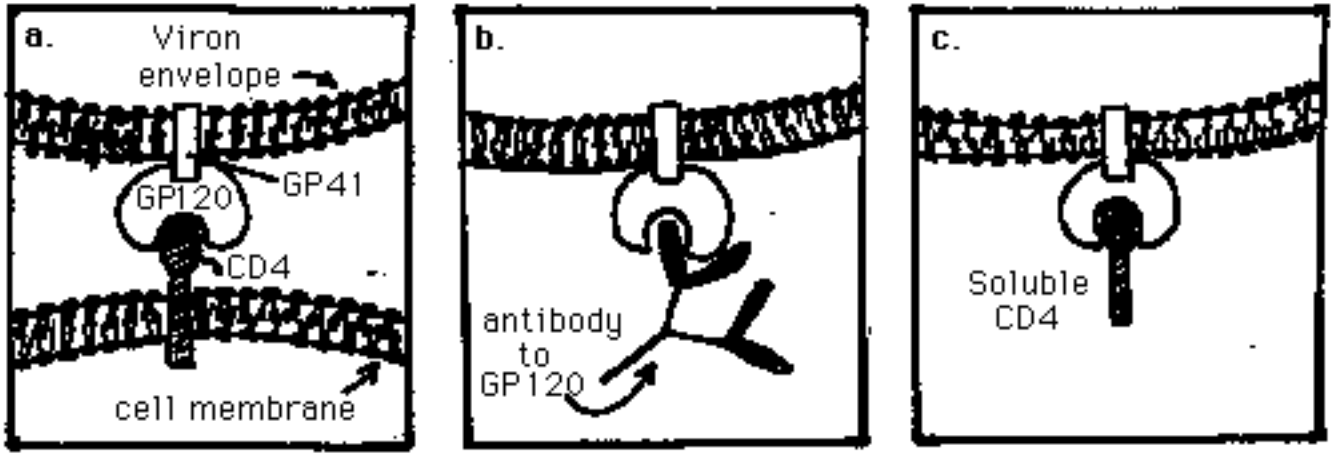
HIV Protein

Strategies Against HIV



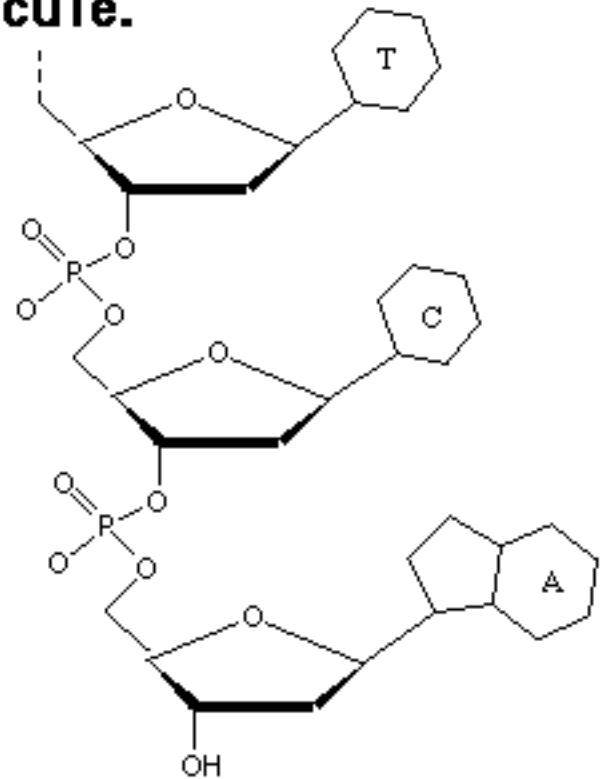
Strategies Against HIV



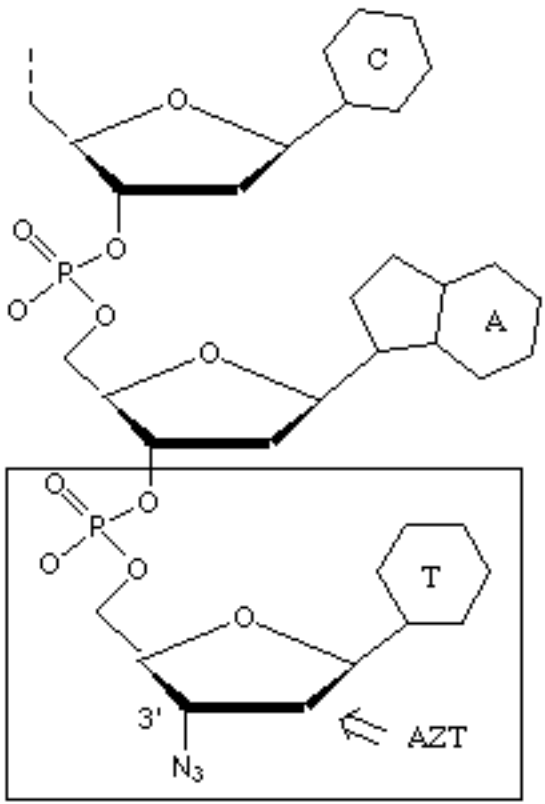


Normal adsorption of HIV virion to T4 lymphocyte (a) and blocking of adsorption by an antibody to the virion proteins GP 120 (b) and by a soluble form of lymphocyte CD4 receptor (c)

Mechanism of azidothymidine (AZT) in blocking replication of the HTLV-III genome. When AZT is incorporated at the 3' end of the growing DNA molecule (2), no further nucleotides can be added to the molecule.



(1)



(2)

Energy

And its interaction with structure

Question:

What is required to produce changes in matter?

Answer:

Energy

Energy takes many forms: Energy

mechanical, heat, electrical,

chemical, radiant, nuclear.

All forms of energy follow the same laws. They are called the

LAWS OF THERMODYNAMICS.

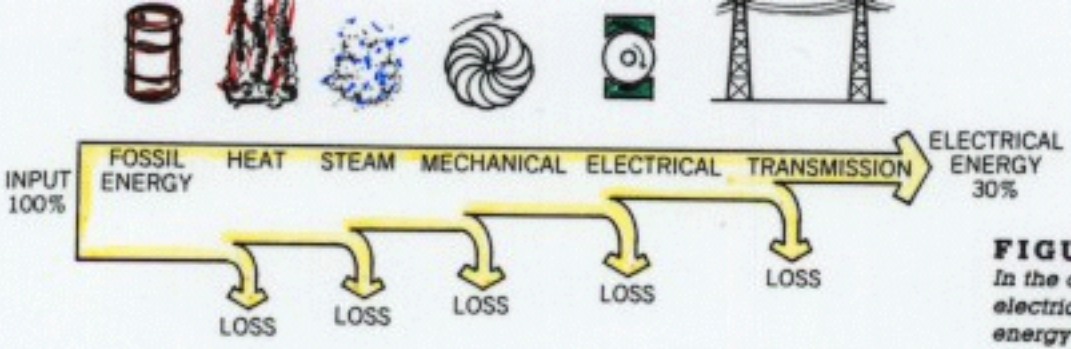


FIGURE 2.19
In the conversion of fossil fuel into electricity about 70% of the original energy is lost.

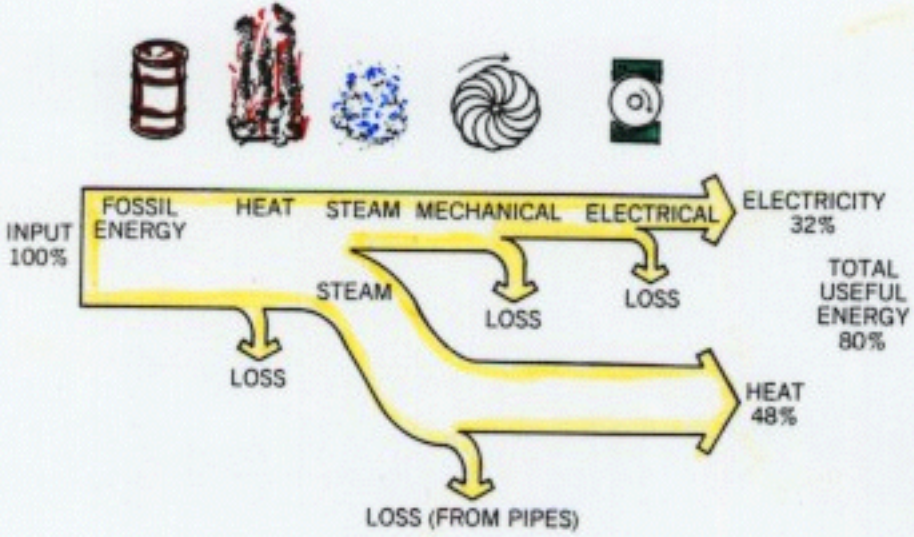


FIGURE 2.20a
Because cogeneration (total energy) systems generate electricity at the building site, they are able to utilize much of the heat normally wasted.

THE FIRST LAW OF THERMODYNAMICS:

CONSERVATION OF ENERGY

Energy can neither be created nor destroyed, only changed in form.

$E = mc^2$ **matter is simply a form of energy**

Conversion of energy from one form to another:

Mechanical energy to make car run

From heat energy produced from burning gasoline

From chemical energy released from breaking chemical bonds in the gas-

Gasoline is a type of hydrocarbon and a fossil fuel, formed from decaying plant matter

The chemical compounds of the plant were made by photosynthesis

Energy for photosynthesis comes from sunlight

Energy is often measured in calories

A calorie is a small energy unit, just enough to warm up a thimbleful (1 gram) of water one degree Celsius.

A more convenient measure is the kilocalorie

1 kcal = 1000 calories

When we talk about the number of calories in food we really mean kilocalories

1 calorie = 4.184 joules (another unit of energy)

1 kcal = 4.184 kjoules (kj)

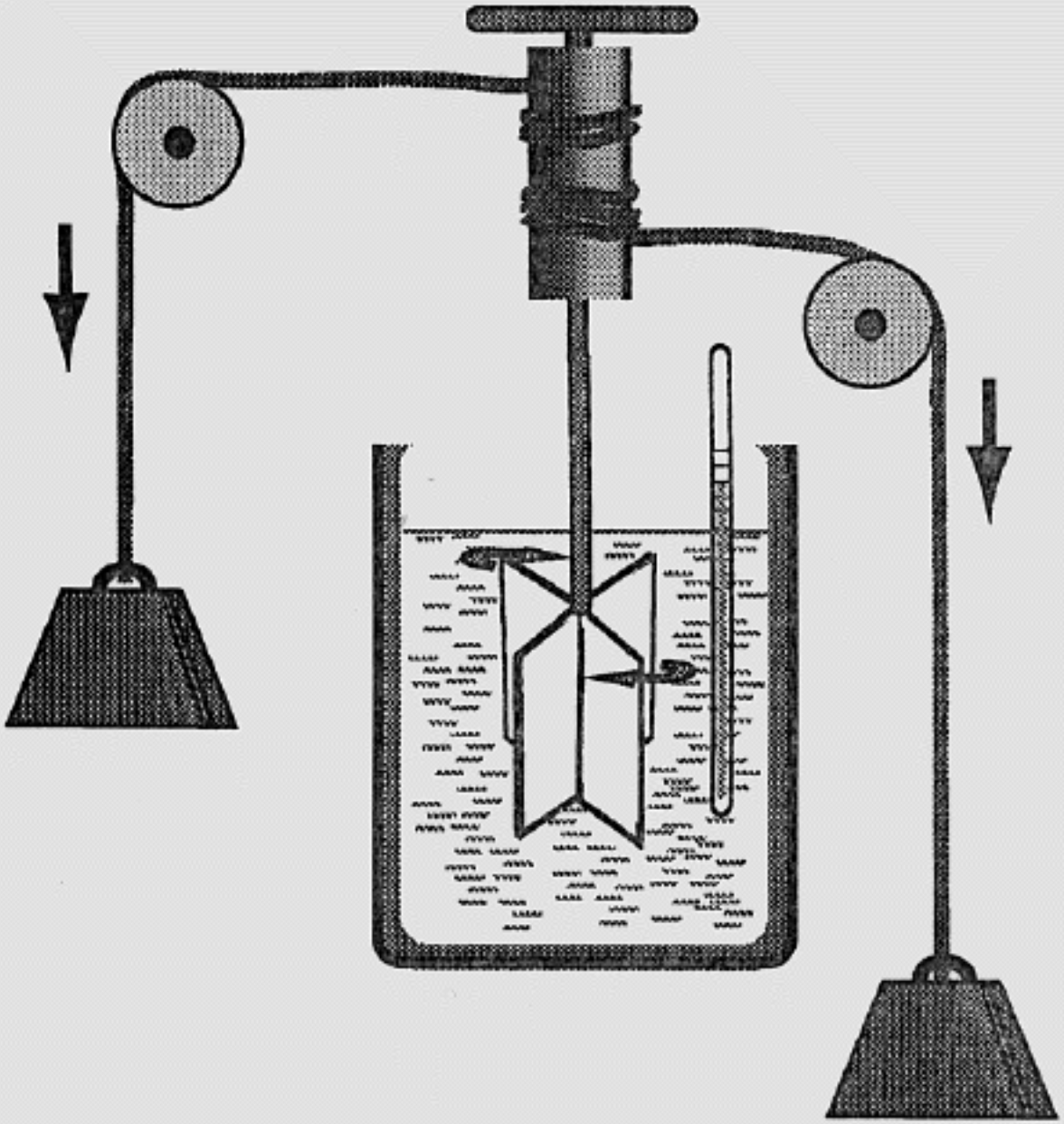


Figure 3–2 Joule's experiment demonstrated that heat is another form of energy by showing that the kinetic energy of a paddle wheel is transferred to heat energy of the agitated water.

Whenever any change takes place in matter, work is done. Work can be defined as energy in transit from one form to another.

Lifting a book off the floor increases its potential energy.

Burning methane changes chemical energy (the energy in the bonds) to heat energy. If we do this in the engine of a car, a portion of the chemical energy is changed to mechanical energy (but not all).

THE SECOND LAW OF THERMODYNAMICS: DEGRADATION OF ENERGY:

A. Heat cannot be completely converted into work in any cyclic process.

B. Heat always flows from the hotter to the cooler part of a system.

C. In any system a disordered state is more probable than an ordered one.

D. The entropy of any system, defined as a measure of the unavailability of energy, tends toward a maximum as time passes

Entropy is a measure of disorder

The entropy of the universe is always increasing

Disorder is always increasing

Isolated systems can be made more ordered – However this takes energy

Energy always tends to even out

A cup of hot coffee gets cold

Entropy Cartoon

A cold drink gets warm

Water flows down hill

THE 2ND LAW OF THERMODYNAMICS HAS THE SAME DEGREE OF TRUTH AS THE STATEMENT THAT IF YOU THROW A TUMBLERFULL OF WATER INTO THE SEA, YOU CANNOT GET THE SAME TUMBLERFULL OF WATER OUT AGAIN.

- J.C. MAXWELL, LETTER TO LORD RAYLEIGH, DECEMBER 6,1870

FORMS OF ENERGY AND HOW THEY ARE MEASURED

1. MECHANICAL ENERGY

Mechanical energy is either potential or kinetic. A body has potential energy if it is in a position from which it could move and do work in the process.

Potential Energy = mgh

If mass is measured in kilograms, height (h) in meters, and g = 9.8 meters/second^2, the energy will be measured in joules.

To calculate the kinetic energy of a body, we need know only its mass(in kg) and its velocity (in meters/second).

Kinetic Energy = 1/2 mv^2

Calculate the potential energy of a book weighing 2 kg sitting in the edge of a table 0.8 meters above the floor.

Potential Energy = mgh

Potential Energy = 2 kg x 0.8 m x 9.8 m/sec^2

Potential Energy = 15.68 kg m^2/sec^2

Potential Energy = 15.68 joules

If we drop the book, how fast is it going when it hits the floor?

Kinetic Energy gained = Potential energy lost
= 15.68 j

Kinetic Energy = $1/2\ mv^2$

Kinetic Energy gained = $15.68\ j = 1/2\ mv^2$

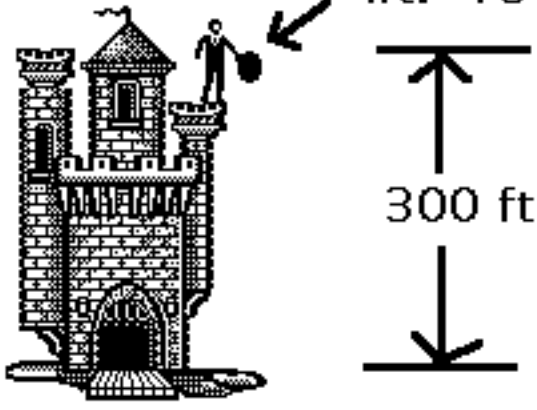
$KE = 15.68\ j = 1/2\ (2\ kg) \times v^2$

$KE = 15.68\ kg \times m^2/sec^2 = 1/2\ (2\ kg) \times v^2$

$$v^2 = \frac{15.68\ kg\ m^2/sec^2}{1\ kg}$$

$v^2 = 15.68\ m^2/sec^2$

$v = 3.96\ m/sec$



$PE = mgh$

$g = 9.8\ m/sec^2$

$KE = 1/2mv^2$

$m = 15\ lb \times .453\ lb/kg = 6.79\ kg$

$h = 300\ ft / 3\ ft/yd \times .9144\ m/yd = 91.4\ m$

$PE = 6.79\ kg \times 9.8\ m/sec^2 \times 91.4\ m = 6084.6\ joules$

$KE = 1/2mv^2 = 6084.6\ kg\ m^2/sec^2$

$1/2 \times 6.79\ kg \times v^2 = 6084.6\ kg\ m^2/sec^2$

$v^2 = 1792.2\ m^2/sec^2$

$v = \sqrt{1792.2\ m^2/sec^2} = 42.3\ m/sec$

Heat applied to a material has one of two effects.

A. It changes its state.

B. It raises its temperature

The states of matter are: Solid, Liquid and Gas

The Solid → Liquid transformation is Fusion
(Reverse is freezing)

The Liquid → Gas transformation is Vaporization
(Reverse is condensation)

Changes of State

The heat required for Solid → Liquid is

Heat of Fusion

The heat required for Liquid → Gas is

Heat of Vaporization

Electrical Energy

Carried by charged particles, either the unit negative charges called electrons or by ions, which may be either positive or negative. An ion is derived from an atom or a molecule by either removing or adding electrons. Removing electrons from an atom or molecule leaves a positive ion; adding electrons creates a negative ion.

Electric energy may be derived from

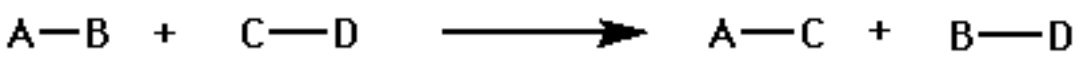
1. Chemical energy in batteries

2. Mechanical and magnetic energy in a generator.

a. The mechanical energy of most generators comes either from falling water or from heat. The heat is derived from burning fuel (chemical energy) or splitting atoms (nuclear energy). Wind energy can also be used to turn generators.

3. Radiant energy in a solar cell

Chemical Energy is stored in chemical bonds



If the bonds in A-C and B-D are stronger than the bonds in A-B and C-D, the reaction gives off energy

(it is Exothermic)

The energy given off is called the heat of reaction

If the bonds in A–C and B–D are weaker than the bonds in A–B and C–D, the reaction takes up energy

(it is Endothermic)