

BIOLOGICAL VIRUSES ARE CERTAINLY LIVING-THINGS AND SWITCHING OFF GENOMIC METABOLISM**Feleke Eriso (PhD)**Biomedical Stream, Department of Biology, College of Natural and Computational Science,
Dilla University, Dilla, Ethiopia

ABSTRACT: *Biological viruses had been concluded that they were nonliving-things whereas some scientists stated that they were transitional things between living-things and nonliving-things. Biological viruses are very tiny organisms with their diameters in nanometers level. They exist everywhere, such like in air, soil, plant and animal body. Biological viruses consist of a protein shell that is referred to as capsid, and a genome made of DNA or RNA, which is tucked inside the capsid. Depending on the type of species, they may also have an envelope made of lipid membrane. Biological viruses possess the genome that performs transformative, reproductive, perpetuative, speciation, and evolution functions. Having these visible scientific truths in mind, biological viruses are certainly living-things. Biological viruses kill (switch off the genomic metabolism of) their target cells and then their genomic metabolism digests the internal contents of the dead/killed target cells into absorbable monomers so as to transform into viruses of their kind; by sequencing the monomers such as amino acids and nucleotides resulted from digestion of nutritive substances, in the form of viral biomass. In other words, after killing (switching off the genomic metabolism of) a target cell the transformation part involves: (i) digesting the biological polymer molecules of the target cell into their absorbable monomers, and (ii) sequencing the absorbable monomers resulted from digestion, in the form of viral polymers that is predetermined by the coded information/directives present in the genome of the virus which entered the target cell. The mechanism of these events is similar to the action of a team of lions which kill (switch off genomic metabolism of) a buffalo before eating the flesh of the killed buffalo in order to transform the flesh (biomass) of buffalo by the genomic metabolism of lions into lions (biomass of lions). The genomic metabolism of the eater organism also transforms the taste & strength of softness for digestibility as a type of flesh (biomass) into the characteristic taste & strength of softness of the eater/predator species's biological polymer molecules or flesh. The term genomic metabolism (metabolism of a genome) means a series of chemical reactions between the genome of a living-thing (i.e., of a species) and its nutritive substances in its compatible environment. An individual living-thing is said alive if and only if its genomic metabolism is going on. A dead, killed, or a body with switched off genomic metabolism is a living-thing in which metabolism of a genome has completely stopped and hence, it is not alive but dead/killed. What happens to the dead body of a living-thing is being digested or decomposed into absorbable monomers and or into inorganic compounds for the circulation of materials in the ecosystem. Switching off the genomic metabolism of a biological virus means killing that virus ; switching off the genomic metabolism of a cell means killing that cell; whereas switching off the genomic metabolism of a multicellular prey by a predator means killing that prey (eg., a buffalo is killed by a lion, or an impala is killed by a python). What follows after killing is: (i) digesting the internal polymers of the target cell (if the killer is a biological virus or a single-celled organism) into absorbable monomers and or into inorganic compounds, or (ii) ingesting, and digesting of polymers of the prey (if the killer is a multicellular organism) into absorbable monomers and or into inorganic compounds for circulation of materials in the ecosystem. Genomic*

metabolism of a biological virus is capable of killing a single-celled organism directly and a multicellular organism indirectly.

KEYWORDS: Absorbable Monomers, Alive, Biological Viruses, Dead, Digestion, Genomic Metabolism, Switching off Genomic Metabolism

INTRODUCTION

In the context of this paper, the term virus means only the biological viruses and does not mean or include what is called the computer virus. Biological viruses are very tiny organisms with their diameters in nanometers level. Biological viruses exist everywhere, such like in air, soil, plant and animal body. Biological viruses consist of a protein shell, or capsid, and a genome made of DNA or RNA, which is tucked inside the capsid. Depending on the type of species, they may also have an envelope made of lipid membrane. A virus is a small **infectious agent** that **replicates** only inside the living **cells** of other **organisms**. Biological viruses can infect all types of **life forms**, from animals and plants to **microorganisms**, including **bacteria** and **archaea**. Biological viruses are found in almost every **ecosystem** on earth. Biological viruses are by far the most abundant biological entities on earth. Biological viruses are also the most numerous biological entities on earth. Bacteriophages are the most abundant group of living things on **the planet** (earth). Most bacteriophages are host-specific and only infect certain species or even strains of **bacteria**. While not inside an infected cell or in the process of infecting a cell, biological viruses exist in the form of independent particles. These independent viral particles, also known as **virions**, consist of: (i) the **genome** made from either DNA or RNA, long molecules that carry coded information; (ii) a protein coat, called the **capsid**, which surrounds and protects the genome; and in some cases (iii) an **envelope** of lipids that surrounds the protein coat. The shapes of these virions range from **simple helical** (linear/filamentous or spiral) and **icosahedral** (circular/spherical) forms for some virus species to more **complex** structures for others [1-5].

The viruses with more complex structures possess a capsid that is neither purely helical nor purely icosahedral, and that may possess extra structures such as protein tails or a complex outer wall. Some bacteriophages, such as **Enterobacteria phage T4**, have a complex structure consisting of an icosahedral head bound to a helical tail, which may have a hexagonal base plate with protruding protein tail fibres. This tail structure acts like a molecular syringe, attaching to the bacterial host and then injecting viral genome into the cell. Viruses can be tens or even hundreds of times smaller than the average bacterium.

Concrete evidences about the fact that biological viruses are certainly living-things

1. In every species of all living-things the unit of both structure & function is the **genome**. In every species of all living-things the only structure capable of self-replicating and building the entire biomass (or body) of each individual organism using the nutritive substances as raw materials or inputs is the **genome**. In other words, the genome of every species transforms the nutritive substances into the living-things with specific accuracy in kind. Similarly, each species of viruses has the genome, DNA/RNA like any other living-thing.

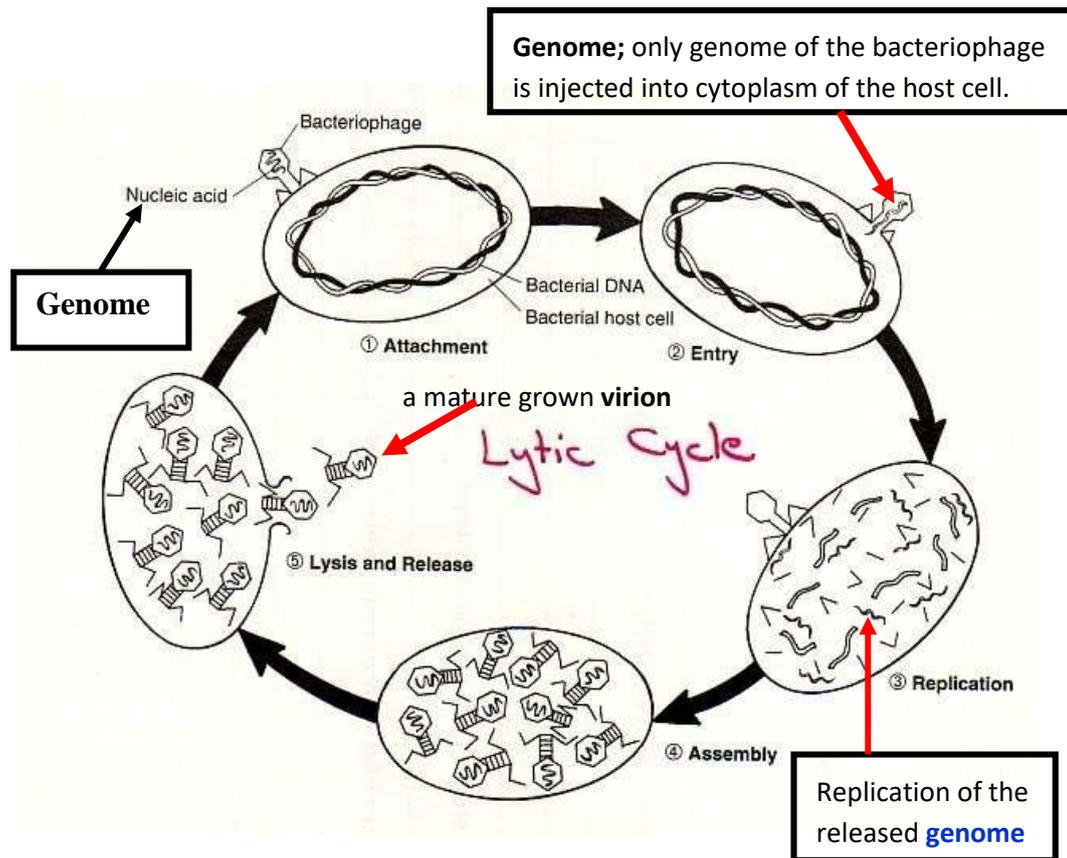


Figure 1: Life cycle of a bacteriophage, demonstrating the transformative and reproductive functions of viral genome (i.e., the genome of a bacteriophage), using the internal/cytoplasmic content of a bacterium as nutritive substances.

In the life cycle of a bacteriophage virus shown above, it is only one naked genome molecule of one individual virus that entered the host bacterium (i.e., a host cell). Then, when the bacterial host cell is lysed, several **virions** coated with capsids, each of which is the exact copy of the parent bacteriophage virus, are released. From one life cycle of viral replication in a host cell as many as 100s to 10,000s (hundreds to several tens of thousands) of progeny viruses, each of which is the exact copy of the parent virus that entered the host cell, are released from the target cell. How can this be true because the **Law of Conservation of Matter** states that matter is neither created nor destroyed. Of course, opposing to this truth only one complete set of genome of one virus entered the host/target cell but 100s-10,000s of progeny viruses, each of which is the exact copy of the parent virus, are released from the target cell killed? This event does not contradict with the “Law of Conservation of Matter” at all, because:

► When the viral **genome** entered the bacterial host cell, the metabolic functions directed by the **genome** of the bacterial host cell are **switched off (killed)** and the metabolic directives of the viral **genome** take over. In other words, the **genomic metabolism** of the virus entered **switched off the genomic metabolism** of the bacterium by directly **digesting** the bacterial genome.

► Then, the genomic metabolisms of the virus digest the internal contents (of the bacterium) such as genome & proteins into absorbable monomers (nucleotides & amino acids) and transform these monomers into the progeny viruses or bacteriophages each of which is the exact copy of the parent bacteriophage whose genome was initially injected into the bacterium killed. The new progeny viruses can be 100s-10,000s in number (see Life Cycle of a bacteriophage above, Fig. 1). The metabolism of a virus is performed by the directives coded in the genome that build capsid and in some species including the bilayered lipid called envelope. It is actually the viral genome that enters the host cell as the determinant of metabolism in the host. The viral genome grows not only in number but also grows in size adding on itself the polymer of protein capsid and in some viral species the polymer of envelope is added. The growth in size of viruses is limited by these two (genome & capsid) or three (genome, capsid, and envelope) polymers put together to a size of a **virion** in viruses of **simple** structure. The viral growth in size is better amplified in viruses of **complex** structure. **For Example:**

• **genome** adds on itself, capsid, neck, collar, tail, tail fibers, base plate, and pins/teeth in tailed bacteriophages as the size of a mature grown **virion** (see Fig. 2), and

• **genome** adds on itself, capsid, three layered icosahedral capsid, and surface fibers in Mimi Viruses as a mature grown **virion** (see Fig. 3).

Similarly, there is a limit (or end) of growth in size in the ontogeny of every species of all animals except plants in which growth in size is continuous until the individual plant dies. Thus, there is growth in size in viruses like in any other species of all living-things.

In summary, the virus enters the host/target cell, it switches off the genomic metabolism of the bacterial host cell by directly digesting the genome & proteins which are the internal contents of the target cell into their absorbable monomers that are used to produce or build new progeny viruses [6-11]. This mechanism is just like that in large animal predators that kill (switch off the genomic metabolism of the prey) and eat the flesh of their **killed** preys so as to increase in size and number of predators. For instance, pythons kill and swallow whole any big animal they can overpower such as reptiles, crocodiles, pigs, monkeys, cattle and humans [12, 13].

In the case of multicellular prey where body organization is at system level, bearing tissues, organs, and systems whose **genomic metabolisms** of different types of body cells are with highly specialized functions and tightly interdependent. In such complex multicellular prey with interdependent genomic metabolisms specialized for specific metabolic functions, cutting blood vessels & pouring blood out of the prey inhibits:- removal of metabolic wastes from individual cells, exchange of gases, and supply of nutrients. Due to some or all of these inhibiting events the interdependent **genomic metabolisms** of all other body cells of the prey are switched off (i.e., the prey is killed). Then, the predator ingests the flesh of the killed prey so as to digest into absorbable monomers and transform into the flesh of the predator species type (e.g., lion) [12, 13] or swallow the whole prey after killing and digest the whole prey into its absorbable monomers to transform into the characteristic flesh of the predator (e.g., python). The mechanism of killing the multicellular prey by python involves **cardiac arrest** that inhibits blood flow to brain, other needy parts of body, or cells and **respiratory arrest**, causing exhalation without inhalation the effects of which switch off the interdependent genomic metabolisms of all other body cells of the prey. In the healthy state, the interdependent genomic metabolisms of all body cells, tissues, organs, and systems with

different specializations in a complex multicellular organism such as a person and other mammals are coordinated by nervous and endocrine systems.

How do pythons attack? They attack in an ambush, wrapping themselves around their prey and crushing it—squeezing tighter as the victim exhales with no inhaling (no breathing in at all). They kill (switch off genomic metabolism of) the prey by suffocation of cardiac arrest within minutes. Both respiratory arrest and cardiac arrest are fatal, but the cardiac arrest is worse than the respiratory one. Pythons have been eating humans in several places & occasions. Example, an Indonesian woman has been killed and swallowed whole by a 7 m long python, reported by local authorities. Pythons can kill a human in minutes and swallow him/her in an hour (Rossman,2017). Literally within a few seconds, a python would wrap its powerful coils around a person's body, cutting off blood circulation to the brain, blocking off airways, and preventing the chest from expanding. From one or all of those reasons, the person would quickly die.

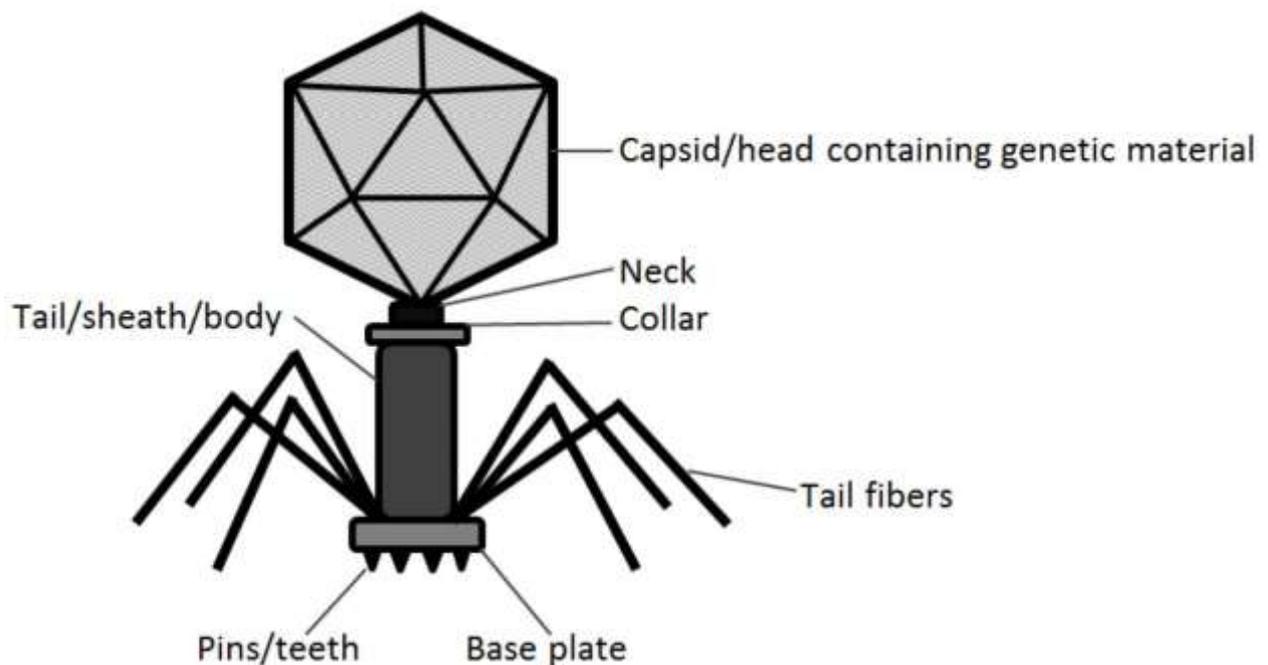


Figure 2: Morphology of a mature grown virion of the tailed bacteriophage.

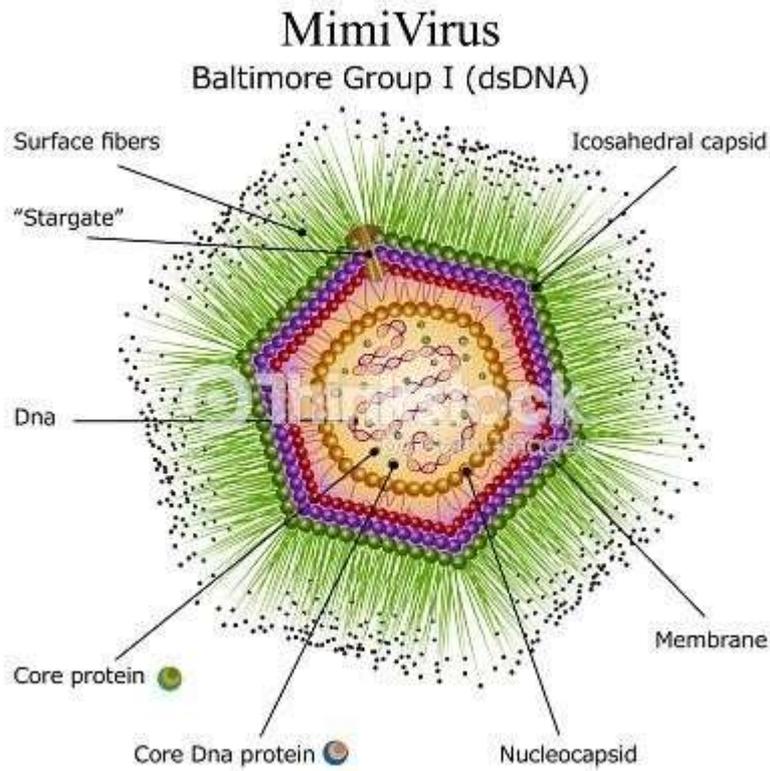


Figure 3: Anatomy of a mature grown virion of Mimi Virus.



Figure 4: A python swallowing a person after killing him/her (switching off the person's genomic metabolism).



Figure 5: A python swallowing (head first) an impala after switching off its genomic metabolism.



Figure 6: A python killing (switching off genomic metabolism of) a cow so as to swallow it whole!!



Figure 7: A python with a big animal prey killed (prey with switched off genomic metabolism), swallowed whole, and being digested to be transformed into python (biomass of a python).

Usually, the prey is swallowed (without chewing) headfirst, so that its horns, limbs, hair, feathers, or spines, do not get stuck and cause injury to the python. The process of swallowing may take several hours or even days. The cells on the stomach walls of the python produce strong digestive juices/enzymes that help dissolve (digest) the prey into absorbable monomers such as amino acids, nucleotides, glucose, glycerol, and fatty acids in order to transform the flesh of the killed prey into the characteristic flesh of the python [12, 13].

Similarly, HIV enters the human target cells referred to as $CD4^+ T_H$ cell and kills (switches off the genomic metabolism of) $CD4^+ T_H$ cell, resulting in a serious numerical decrease of $CD4^+ T_H$ cells in the body of the HIV patient. As $CD4^+ T_H$ cells are immunocompetent cells in the body of humans and the decrease of $CD4^+ T_H$ cells in the body of the patient leads to death (switching off genomic metabolism) of the patient due to infections by opportunistic pathogens. It is to prevent the development of AIDS that $CD4^+ T_H$ cells are injected into HIV positive patients under medical care in hospitals. With the same concept, when Ebola virus enters human target cells it kills (switches off the genomic metabolism of) human target cells and transforms internal contents or biomass of human target cells into Ebola viruses. The cumulative effect of this mechanism kills not only the target cells inside the body of the patient, but the case fatality (death rate) of the patients themselves can be 25% to 90%. Biological viruses kill (switch off the genomic metabolism of) their target cells and then their

genomic metabolism digests the internal contents of the dead/killed target cells into absorbable monomers so as to transform into viruses of their kind; by sequencing the monomers of nutritive substances resulted from digestion, in the form of viral biomass. In other words, after killing (switching off the genomic metabolism of) a target cell the **transformation part** into viral biomass involves:

► **digesting** the biological polymer molecules of the target cell into their absorbable monomers, and

► sequencing the absorbable monomers resulted from **digestion**, in the form of viral polymers that is predetermined by the coded information/directives present in the **genome** of the virus which entered the target cell.

The mechanism of these events is similar to the action of a lion, or of a team of lions which kill (switch off genomic metabolism of) a buffalo before eating the flesh of the killed buffalo in order to transform the flesh (biomass) of buffalo by the genomic metabolism of lions into lions (biomass of lions). The genomic metabolism of the eater organism also transforms the taste & strength of softness for digestibility as a type of flesh (biomass) into the characteristic **taste** & strength of **softness** of the eater/predator species's biological polymer molecules or flesh. The chemical composition of **absorbable monomers** i.e., nucleotides (from viruses to humans) obtained after digesting the **genome** of any one species of all living-things is the same. The term **genomic metabolism (metabolism of a genome)** means a series of chemical reactions between the **genome** of a living-thing (i.e., of a species) and its nutritive substances in its compatible environment directed/dictated by the **coded information** in the genome. An individual livingthing is said **alive** if and only if its **genomic metabolism** is going on. A **dead, killed**, or a body with **switched off genomic metabolism** is a living-thing in which metabolism of a genome has completely stopped and hence, it is not alive but dead/killed. What happens to the dead body of a living-thing is being digested or decomposed into absorbable monomers and or into inorganic compounds for the circulation of materials in the ecosystem. Switching off the genomic metabolism of a biological virus means killing that virus ; switching off the genomic metabolism of a cell means killing that cell; whereas switching off the genomic metabolism of a multicellular prey by a predator means killing that prey (eg., a buffalo is killed by a lion, or an impala is killed by a python). What follows after killing is:

► digesting internal polymers of the target cell (if the killer is a biological virus or a singlecelled organism) into absorbable monomers and or into inorganic compounds, or
 ► ingesting, and digesting polymers of the prey (if the killer is a multicellular organism) into absorbable monomers and or into inorganic compounds for circulation of materials in the ecosystem.

One of the tottering and confused reasons for the fact that viruses are not living-things is that viruses cannot reproduce or replicate outside living cells and therefore, we can conclude that viruses are nonliving-things. In order to understand why viruses reproduce inside living-cells, we have to know what the nutritive substance of a virus is. The nutritive substance of any individual biological virus is only the internal content of its target or host cell and this internal content of the target cell is transformed, by the genome (genomic metabolism) of the virus that entered the target cell, into several daughter biological viruses. The mechanism how that is done at the same time when the virus enters the target cell, the virus kills (switches off genomic metabolism of) the target cell and the internal contents are digested by the genomic

metabolism of the virus & transformed into several daughter viruses that are released from the same killed or target cell.

What is left behind of the target or host or of the killed cell is the lysed or ruptured debris. Hence, a biological virus is a living-thing.

One of the reasons presented by misleaders is that viruses do not move and therefore, biological viruses are not living-things. Actually the viruses do move. For instance, it is by movement that the bacteriophage attaches itself to the surface of a bacterium with the tip of the tail which internally contains a hollow tube that is like the needle of a syringe. This hollow tube is pushed into the cytoplasm by pushing movement of the virus. Then, the contracting movement of the head part capsid releases out the genome into cytoplasm of the bacterium. Self-replication of the genome into parts repeatedly into hundreds to tens of thousands is by involving movement. Assembling of newly synthesized components into mature grown virion is by involving movement. The well grown progeny virions are released out of the lysed or ruptured debris of the target cell by spectacular movement. Therefore, saying that viruses do not move is false & misleading.

The complexly organized structures of human body (polymers, organelles, cells, tissues, organs, and systems level) are built by the coded directives found in the **genome** of *Homo sapiens*; the structures of a single-celled organism, for example, *Entamoeba histolytica* (polymers, and organelles level) are built by the coded information in the **genome** of *E. histolytica*; and similarly, the structures of a biological virus, for instance, Enterobacteria phage T4 (polymers level) are built by the coded directives present in the **genome** of *Enterobacteria* phage T4.

Some biological viruses undergo a **lysogenic cycle** where the viral genome is incorporated by genomic **recombination** into a specific place in the host's genome. The viral genome is then known as a "**provirus**" or, in the case of bacteriophages a "**prophage**". Whenever the host divides, the viral genome is also replicated. The viral genome is mostly silent within the host. At some point, the provirus or prophage may give rise to active virus, which may lyse the host cells. Enveloped viruses (e.g., HIV) typically are released from the host cell by **budding**. During this process the virus acquires its envelope, which is a modified piece of the host's plasma or other, internal membrane. In short, though budding does not immediately destroy the host cell, its process will slowly use up internal contents as well as the cell membrane of the host cell, and eventually lead to the cell's demise i.e., death [14-25].



Figure 8 : Two lions have killed (switched off the genomic metabolism of) a buffalo and are eating its flesh that will be digested into the absorbable monomers to be transformed into the biomass as well as into the individuals of the eater lions kind.



Figure 9a: Many dead bodies of human victims (placed together in one depression of ground) whose genomic metabolisms are switched off by genomic metabolism of Ebola virus (during the most recent outbreak of it) in West Africa.



Figure 9b: A human victim whose genomic metabolism is switched off by genomic metabolism of Ebola virus (during the most recent outbreak of it) in West Africa.



Figure 9c: A human victim whose genomic metabolism is switched off by genomic metabolism of Ebola virus (during the most recent outbreak of it) in West Africa.

2. Like other living-things, biological viruses vary in their shapes due to the variation or difference in their genomes.

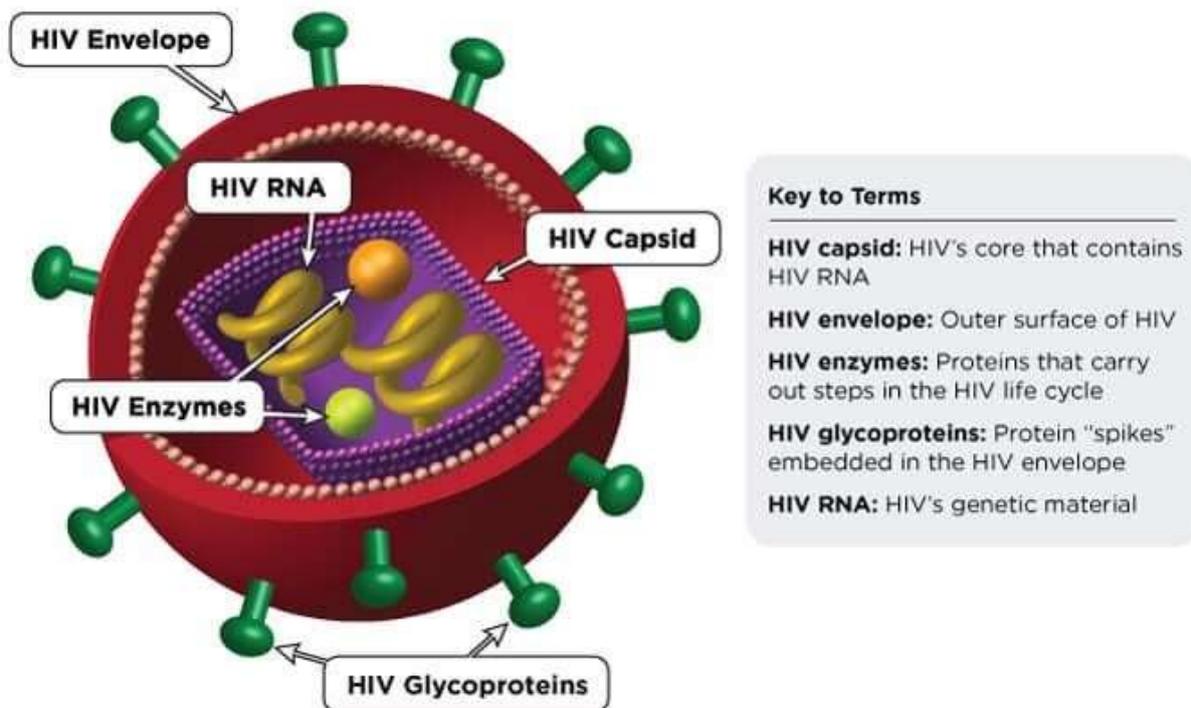


Figure 10: Anatomy of HIV virus whose genome consists of 2 molecules or segments of RNA.

3. It is because the genome is the unit of both structure and function that the **DNA Finger Print** is used for the Accurate Identification at distinctive individual level. Similarly,

in each of the individuals of **Ebola virus** in each of its daughter generations, there is distinctive species accuracy in kind of being **Ebola virus** due to the kind of their **genome**.

4. Therapeutic genome editing:- has been found to be applicable in Agriculture and Medicine because it is the genome that forms (produces or makes) the biomass as well as the entire morphology & anatomy of the body of the living-thing that contains it. The cells of higher organisms can be infected by naked viral genome, i.e., nucleic acid, yielding normal virions (nucleocapsids) in the daughter generation. The parent generation of the virus that enters the host cell is a naked genome without any protein coat called capsid, then the individual viruses of the daughter generation that emerge from the host cell must be naked ones without capsid because matter is neither created nor destroyed. But in this case, when the naked genome of the parent virus enters a host cell, the daughter individual genomes of the parent virus emerge, covered with capsid (virions) instead of being naked, from the host cell. The directives or coded information to produce/synthesize capsid protein covered virions or individual viruses that are like the original intact parent virus are contained in the sequence of nucleotides of genome. This is the direct controlled proof/evidence for the fact that the non-genome parts/organelles or structures of every living-thing are produced by the coded information/plan of its genome using its nutritive substances as raw materials in its compatible environment and does not contradict with the Law of Conservation of Matter which states that “matter is neither created nor destroyed”. The genome is capable of self-replicating and thus can increase the number of molecules of itself together with the non-genome parts/organelles or structures of every living-thing by transforming its nutritive substances as raw materials/inputs into living-things in its compatible environment.

5. Genome has the code system of information that codes not only for structural & functional proteins, but also codes for the catalytic enzymes that catalyze the metabolic production or synthesis of all nonprotein biological molecules of the body such as cellulose, other polysaccharides, lipids, nucleic acids and vitamins. For instance, the envelope of bilayered lipid that encloses nucleocapsid in some species of biological viruses.

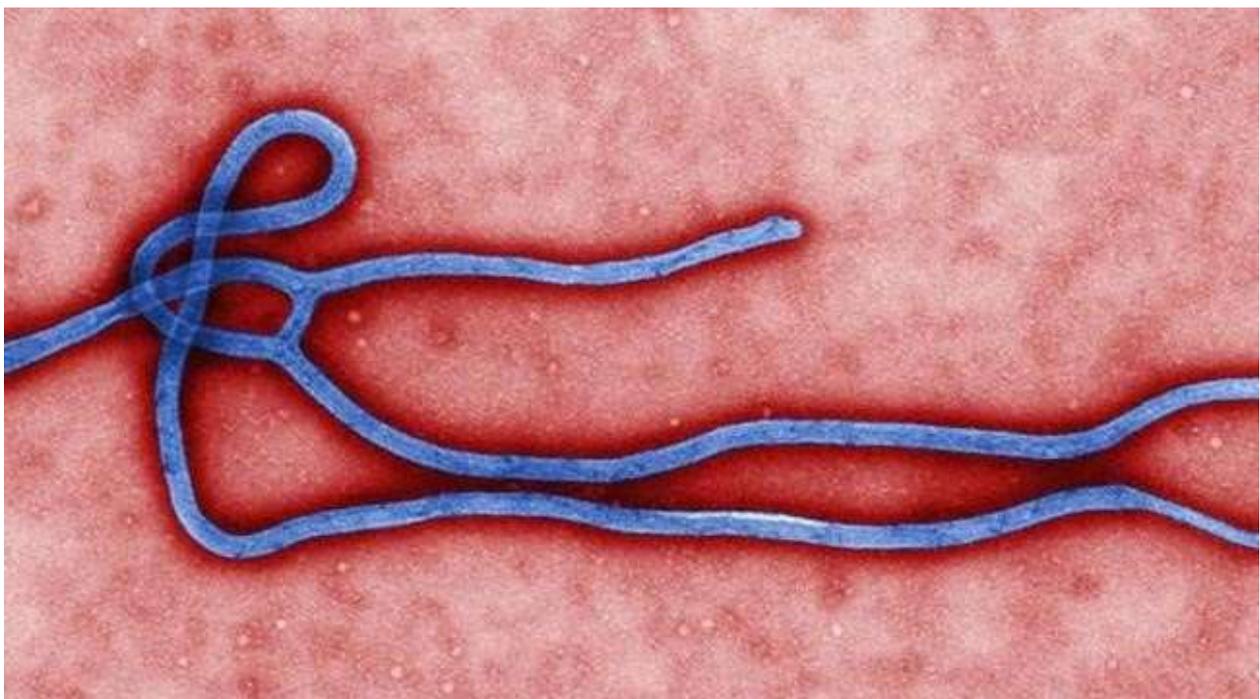


Figure 11: Morphology of an Ebola Virus.

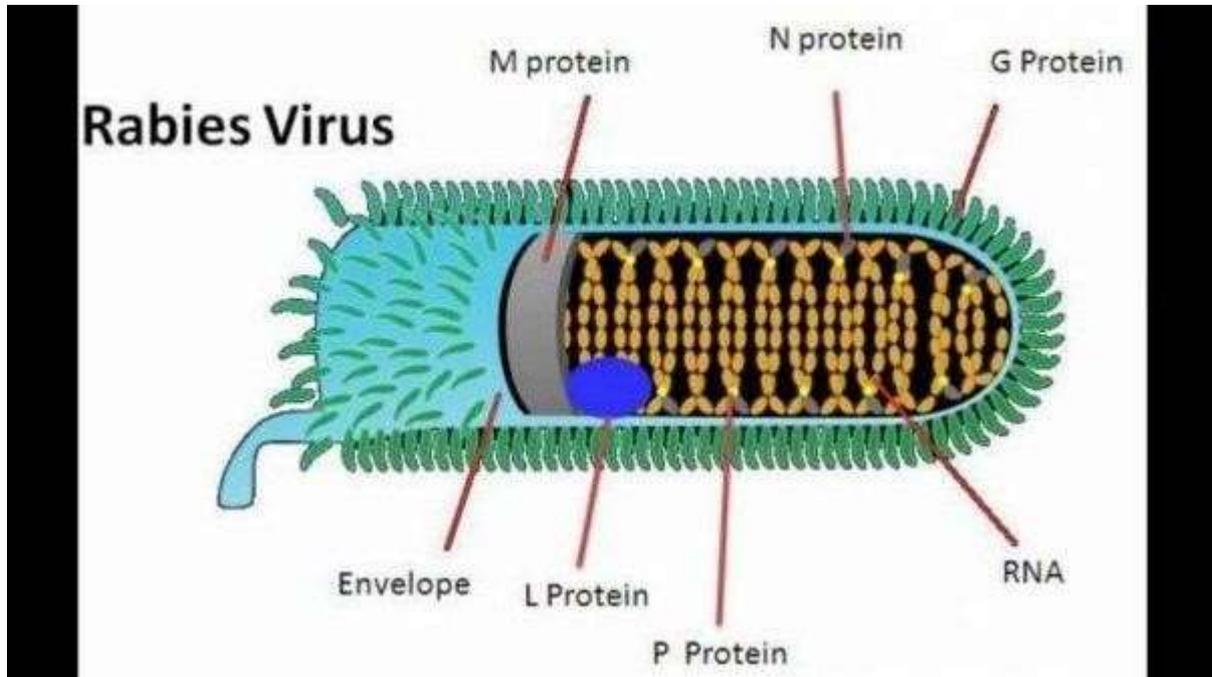


Figure 12a: Anatomy of a mature grown virion of Rabies Virus.

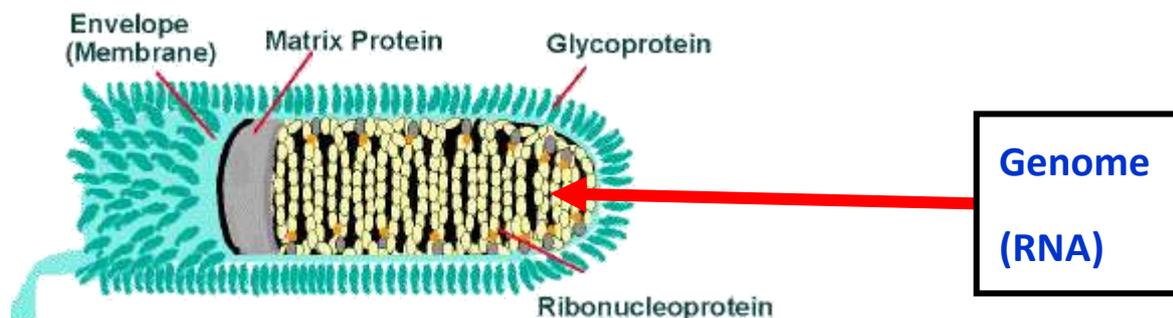


Figure 12b: Anatomy of a mature grown virion of Rabies Virus.

6. Genome is capable to self-replicate, being able to code for replication of itself from transformable nutritive substances of its compatible environment [12,13]. Crick & Watson in their DNA Model for which they won novel prize have missed three very important points:

First, the concept of transformation of nutritive substances into several other daughter DNAs via self-replication was not realized and their concept of DNA Model will be in conflict with the

“Law of Conservation of Matter”. The truth of transformation is directly observed in the selfreplication of genomes of the biological viruses in host cells of higher organisms.

Second, in spite of the ready made availability of Mendel’s principles of genes (segments of DNA) before their physically seeing the DNA molecule, Crick & Watson failed to realize the fact that if there was no self-replication of genomes in all species of living-things, there would be no living-things on earth as there would be no cell division. Every mitotic cell division or every two rounded meiotic cell division is invariably preceded by self-replication of genome of the cell; in other words, all DNA molecules of the genome undergo self-replication in the interphase stage known as S-phase in cell cycle.

Third, Crick & Watson were not aware of the fact that all DNA molecules that form the full set of a genome do self-replicate simultaneously to signal or to initiate the cell division of mitotic or meiotic type. It is only after genome’s self-replication has been completed that the two rounded meiotic cell division (meiotic division I and meiotic division II) including the mitotic division both in animals and plants can take place. In short, in any type of cell both mitotic and meiotic cell divisions can take place if and only if the self-replication of all DNA molecules of the genome is performed in the S-phase within the Interphase.

7. The chemical composition of genome from biological viruses to humans is the same, being phosphate, 5-carbon or pentose sugar and nitrogenous bases. This is why deletion or insertion of genes in genome editing and delivery of genes by viral vectors into host cells is practically possible at present. The information in DNA is stored as a code made up of four chemical bases: adenine (A), guanine (G), cytosine (C), and thymine (T)/uracil (U). In the case of some viruses whose genome is RNA, the nitrogenous base instead of thymine (T) is uracil (U). Human DNA consists of about 3 billion bases, and more than 99 percent of those bases are the same in all people. The order, or sequence, of these bases determines the information available for building and maintaining an organism, similar to the way in which letters of the alphabet appear in a certain order to form words and sentences. DNA bases pair up with each other, A with T and C with G, to form units called base pairs. Each is also attached to a sugar molecule and a phosphate molecule. Together, a base, sugar, and phosphate are called a nucleotide. Nucleotides are arranged in two long strands that form a spiral called a double helix. The structure of the double helix is somewhat like a ladder, with the base pairs forming the ladder’s rungs and the sugar and phosphate molecules forming the vertical sidepieces of the ladder. The human Genome Project has estimated that humans have between 20,000 and 25,000 genes. Generally, in the kind of chemical composition of a biological virus and of a chromosome are the same as each of them is a **nucleic acid** coated (covered) with protein. In other words, a biological virus is a **nucleoprotein** (nucleocapsid) except a few viruses that possess additional envelope of lipid and a chromosome is also **nucleoprotein**. The exact repetitive building block of DNA or RNA (in some RNA viruses) molecule is a nucleotide.

The wonderful cause for the differences of:

- **genes** in the kind of **trait** they **transfer**, and
- **genomes** in the kind of species they **perpetuate**, is the **sequence of nucleotides** in each of the

DNA or **RNA** (in some RNA viruses) molecules. The change in the **number of DNA** or **RNA** (in some RNA viruses in which the genome is composed of RNA) **molecule/s** does cause a

drastic difference/change that can result in the emergence of a **brand new species** in a single generation time. The only determinant (i.e., the exact) part of the nucleotide to cause the **observable differences** among genes in the kinds of trait they transfer or among genomes in the kinds of species they perpetuate by way of nucleotide sequence is the sequence of the **nitrogenous base-pairs**. This is true because in the nucleotide molecule the phosphate, and pentose sugar groups are identical in all nucleotides and cannot cause any difference in any kind of nucleotide sequence. The gene is defined as a segment of a DNA or RNA (in some RNA viruses) molecule.

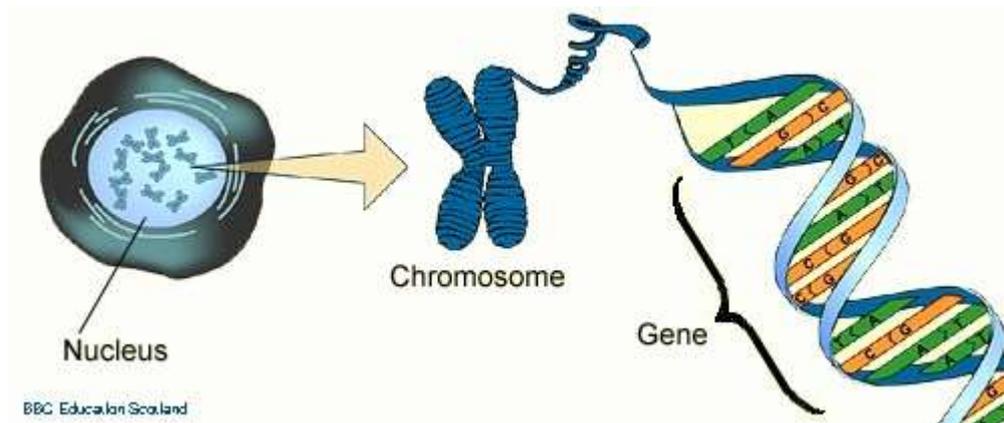


Figure 13: The gene showed where it is a segment of a DNA molecule drawn out from one of the two sister chromatids of a duplicated chromosome.

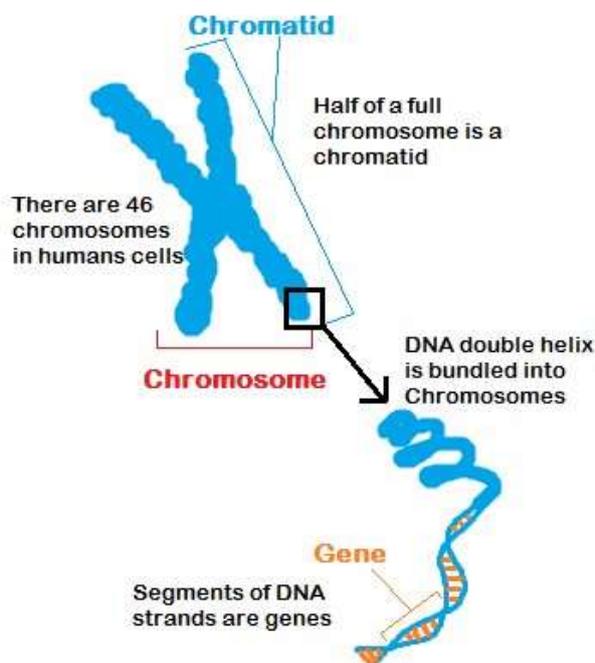


Figure 14: A gene located as a segment of a DNA molecule found in one of the two sister chromatids of a duplicated chromosome.

This duplicated chromosome did not have two sister chromatids before its being duplicated and contained only one molecule of DNA. The cell with this chromosome is in the process of meiotic division I.

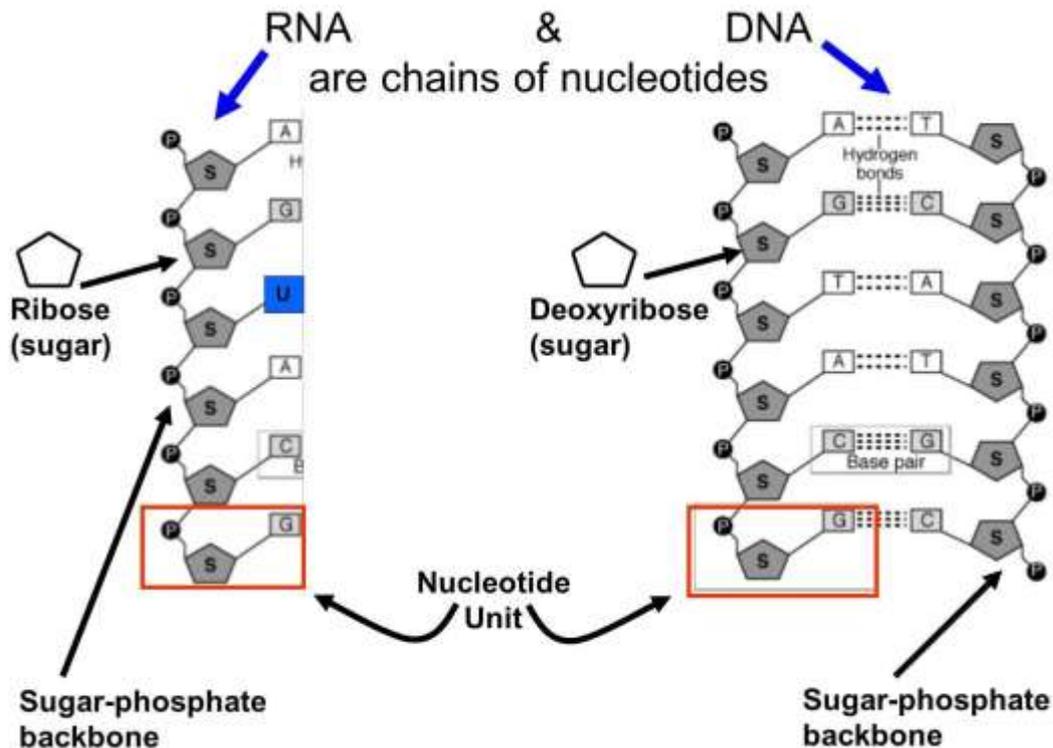


Figure 15: The structures of nucleotides displayed to show the fact that the phosphate, and sugar groups cannot cause any difference among genes or among genomes via the sequence of nucleotides because they are identical in all nucleotides from those of biological viruses to those of man.

The nucleotides are shown both in **DNA** and **RNA** molecules.

8. Genome Bank. Saving the genome of a species of a living-thing in a bank is saving that species so that it will be able to perpetuate against extinction. A single or a separated or an isolated gene for a single trait from its genome cannot be stored in database with the technology of the present time and it cannot perpetuate the species either like the full set of the **genome** it belongs to; actually, what is stored in the database of bank is the **genome**. A **gene** transfers only **one trait** of an organism to the next generations and it is only the **genome** that **perpetuates the species of the organism** against extinction by exerting its **dictative control of self-replication** to a countably indefinite number of generations. Therefore, the term Gene Bank must be corrected and be replaced by **Genome Bank**. The role of genome is exactly the same in biological viruses as in all other species of living-things.

9. Genome is the transformer of nutritive substances from one form into another among livingthings. This is what is seen in food-chain of eating and being eaten. The nutritive substances eaten or absorbed are transformed into the individual organisms of the eater species which contained the transformer genome. When grass is eaten continually by sheep, the grass

is transformed into several other sheep by the sheep **genome** (by the sheep's **genomic metabolisms**). On the other hand, if the same grass is eaten continually by cattle, the grass is transformed into several other cattle by the cattle genome (i.e., by the cattle's **genomic metabolisms**) [14-21]. In the same transformative way, the nutritive substances of viruses are transformed into viruses by the genomes of viruses.

10. A single-celled Zygote of any multicellular plant or animal species develops (grows) into the reproductive adult stage that belongs to the species of its parents only. This is so because into what species a zygote (an offspring) develops is exclusively determined by the type of **genome** possessed by the parents. Example: A zygote of humans develops into the reproductive adult that belongs to the species of *Homo sapiens* only. A zygote of *Podocarpus gracillor* plants develops into the giant reproductive plant which belongs to the species of *Podocarpus gracillor* only. The uncoated **genome** of the deadliest Zaire Ebola virus self-eplicates in its human host cell after penetration, giving rise to several copies of the full set of genome which will develop into virions (where each full set of genome is coated with protein called capsid) that belong to the type of deadliest Zaire Ebola virus only and not into any other type of virus. A zygote of *Equus asinus* donkeys develops into a reproductive adult donkey that belongs to the species of *Equus asinus* only without making mistakes by belonging to any other species of animals!!

11. A person's **ontogeny** begins from a single-celled **zygote** and proceeds to the adult stage of maximum body weight, that consists of trillions of cells, by way of mitotic cell divisions. In these countably infinite number of **mitotic cell divisions** that occur in the body of a person, one cannot think of any one cell division of these to take place in the body of a person without the preceding self-replication of the genome as a signal, i.e., all DNA molecules that form the complete set of the genome do replicate simultaneously prior to each of the mitotic cell divisions. If cell division of meiotic as well as mitotic type is to occur in any type of cell in the body, the genome must self-replicate first and then only the sister chromatids are formed. The formation of two sister chromatids from a single chromosome that contains only one DNA molecule is a substantiated & spectacular evidence for the fact that the double helix DNA molecule is selfreplicated into two daughter DNA molecules that are identical to their parent DNA molecule. The two successive meiotic cell divisions (meiotic division I & meiotic division II) to produce gamete/s are initiated by only one preceding self-replication of the genome found in that gamete producing cell. Each sister chromatid contains one double helix DNA molecule and also any one normal chromosome always contains only one double helix DNA molecule. Now, it can be seen that the cell division of any kind of cell found in any species of living-things is invariably ordered to occur or signaled to take place by the self-replication of its genome. No selfreplication of genome in a cellular organism means no cell division. Thus, if there was no replication of genomes in all species of living-things, there would be no living-things on earth as there would be no cell division/viral replication.

The cause of being different of species from one another (i.e., speciation) among all living things from viruses to humans is the **genome** by its being different in each species from that of any other species of living-things. A medical doctor knows the fact that the immune system of a recipient rejects a transplanted kidney, but does not know the reason for that defensive response if he/she does not internalize the principles or laws of **Genome Model of Living-things**. A farmer selects a strain of cattle which yields about 38 litres of milk per day, leaving another strain of cattle that yields less than 1 litre of milk per day and does not know the reason

why that difference in the yield of milk exists if he/she does not know the principles, rules, or laws imparted by the **Genome Model of Living-things**. Specific species of cattle, sheep, and goat are referred to as selected species/breeds for their very high yield of flesh and disease-resistance. This inheritable productivity & disease-resistance is due to the type of **genome** they possessed; in other words, it is due to the **genome** they inherit and transfer.

Scientists of the world have clearly stated that the study of living-things is defined as **biology** and they have unanimously admitted that they don't know what a living-thing is! Therefore, they don't have any scientific ground neither to say that biological viruses are nonliving-things nor to say that biological viruses are transitional things between living-things and nonliving-things, because they don't know what a living-thing is in the first place!! Being a living-thing is **all** or **none**, i.e., possessing a **genome** & being a living-thing or not possessing a **genome** & being a nonliving-thing. There is nothing at all as such that can be classified as transitional things between living-things and nonliving-things. If there are scientists who classify biological viruses as transitional things between living-things & nonliving-things, their generalization is false and they must stop misleading student children & confusing scientists of both pure and applied biological sciences. The best evidences, that one can show in literatures of both pure & applied biological sciences for the fact that what a living-thing is has not been known by scientists of biological sciences, are the **fill in blank errors** of biological terms. For example: **gene bank** is a wrong term & it must be replaced by **genome bank** against extinction; and **cancerous cell** is a wrong term & it must be replaced by **cancered cell & cancerous genome** in immunology courses. The strains/specific species of cultivated crop plants are selected for their very high agricultural productivity and disease-resistance. This is due to the type of genome possessed by the living crop plant species selected for cultivation. Similarly, the type of genome is responsible for chicken species selected for very high yield of eggs or flesh.

Not knowing what a living-thing is, led to not only saying that biological viruses are nonlivingthings or transitional things between living-things and nonliving-things, but it also led to stating that **cancered cells are pathogens** in diseases of cancer which is a misleading and an erroneous concept in biological sciences whereas the correct pathogen is the **cancerous genome** of the cancered cell. In cancered cells the cancerous genome transforms its nutritive substances rapidly into cancered cells which are free from apoptosis. Not only that, the term gene bank used to preserve a species of a living-thing against extinction is also an academically paralyzing and misleading concept in biological sciences whereas the correct term for the concept is **genome bank**.

A plant can be a medicinal plant against a particular disease, because of its **genome** that can synthesize the **bioactive molecule** which is **lethal** or **toxic** to the causative agent of the disease.

Gregor Mendel's investigation of genetics was a **minute piece of hint** about the secrets of living-things. Because of its minuteness Mendel's hint was not enough to disclose the whole miracles of living-things and that was the very reason for why scientists were not able to define what a living-thing was before the emergence of **Genome Model** of living-things.

The reaction between a **genome** and **its nutritive substances in its compatible environment** is termed **metabolism**. Every individual living-thing of all species from viruses to humans can be alive if and only if this reaction of metabolism is going on or if it is in an inert or hibernated state with the potential to be reactivated to resume the **metabolism**. For example:

provirus, prophage, hibernated multicellular animals, seeds of flowering plants which germinate and grow through resuming **metabolism**. The determinant for:

- ▶ the occurrence/existence of **metabolism**, and
- ▶ the type of **phenotype** and what **species** the resultant outcome of the metabolism would be

is the **genome** with its inheritable system of coded information [26-28]. Because of this determinant role of genome in metabolism of the whole system of life, metabolism of living things is termed **genomic metabolism** in order to wipe out the miracles of misleading student children & confusing scientists of both pure and applied biological sciences. The term **genomic metabolism** is forwarded for use in literature as well as for impartive classroom instructions. Genomic metabolism of an organism can be switched off in one of the following two ways:

1. by **directly** digesting or damaging the **genome** of a single-celled organism. **Example:** see Fig.1 of this paper in which the **genome** of the bacterium is directly **digested** by **viral genomic metabolism**.
2. **indirectly**, by switching off the **genomic metabolisms of some body cells**, the interdependent effects of these switched off cells will **switch off the genomic metabolisms of all other body cells**, in a multicellular organism in which:

•the genomic metabolisms of body cells, tissues, organs, and systems are specialized for specific metabolic functions, and tightly interdependent. **Example 1:** cut blood vessels & pour blood out of the prey's body and due to this damage other intact body cells lose supply of O₂, nutrients and removal of CO₂ as well as other metabolic wastes. As the result, the genomic metabolisms of all body cells will be switched off i.e., the prey is killed. This is the method used by a lion to kill a buffalo before eating its flesh. **Example 2:** a multicellular prey killed by a python, the killing

effect of **cardiac arrest** switches off/inhibits the genomic metabolisms of cells involved in circulation and that results in switching off the genomic metabolisms of all other body cells at distant body parts. The **respiratory arrest** method inhibits or switches off the genomic metabolisms of cells involved in inhalation (breathing in) and the interdependent effects of these switched off cells result in switching off the genomic metabolisms of all other cells of the prey's body. Now, we say the prey is killed and the python will swallow it.

Conclusion



Being a living-thing is only due to the possession of a **genome**.



The only cause or reason for the differences among different species of all living-things is the difference in their **genomes**.



Biological viruses possess genomes and the differences among the species of biological viruses is caused by the differences in their **genomes** like in all other living-things.

 Every species of biological viruses inherits **genomic traits** from its parent and transfers to its daughter generations like any other species of all living-things.

 Biological viruses have the **genome** that performs **transformative, growth in size, reproductive, perpetuative, speciation, and evolution** functions. Having these visible scientific truths in mind, biological viruses are certainly living-things.

 **Genomic metabolism** of a biological virus is capable of switching off the genomic metabolism of a single-celled organism by **directly** digesting its genome (eg. bacteriophage) and can also kill multicellular organisms such as humans (eg, HIV kills humans) **indirectly** due to the interdependent effects of specialized metabolic functions of all body cells.

 Biological viruses do **grow both in size & number**. In order to grow (i.e., to increase) both in size & number of individual viruses, they have to take up their nutritive substances for metabolic transformation into biological viruses, because matter can neither be destroyed nor created. The only nutritive substances of biological viruses are the **internal contents of living-cells**. That is the reason for the fact that biological viruses grow both in size & number only in living-cells by **switching off the genomic metabolisms of their host cells**.

Ethical clearance

I declare that no ethical error is committed in the production of this paper.

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