LESSON 6: INSIDE A CELL

Cells are like little cities. They are surrounded by a wall, like ancient human cities were. The wall has portals and gates that let certain things in and out at certain times. They have power plants that provide energy for factories, vehicles, and tools. They have a library full of coded information. They have roads on which molecular taxis travel. They have recycling centers. They have factories that build most of the structures (and tools as well).

If a virus were a person, what would be its thoughts about cells? Viruses do not have the ability to reproduce on their own. They will need to rely on a lot of the machines and structures inside their host cell. Outside of a cell, viruses have no source of energy. Without energy, nothing can move or change. Viruses also don't have the right machines for making proteins. They carry instructions for making proteins, but have no way to actually make them.

Before we can discuss how a virus takes over a cell, we need to be familiar with the parts of a cell, and know what types of raw material and energy will become available to the virus. Cells contain structures called organelles, which means "little organs."

NUCLEUS: This is like the library of the cell and contains most of the cell's DNA (mitochondria also have a little DNA). Inside the nucleus you find the genome (the DNA that contains every bit of information necessary for building the body the cell is part of). The nucleus has tiny holes, or portals, that restrict what can go in and out. The DNA always stays inside.

NUCLEOLUS: This is an area inside the nucleus where RNA is made that will be folded up to make ribosomes. The RNA leaves the nucleus unfolded because the portal holes in the nucleus are so tiny. After it is out, the RNA will fold up to make ribosomes.

MITOCHONDRIA: This is where the ATP "batteries" are recharged. ATP is a molecule with three phosphates (PO4) on the end. When the third phosphate pops off, energy is released. The mitochondria uses energy from food molecules to power little machines that put the third phosphate back on ATP making it usable again. Everything in the cell that needs energy uses ATP (or a similar molecule called GTP).

LYSOSOMES: The are the recyclers of the cell. They can chop and recycle just about anything, whether it is made of sugars, lipids, proteins, or nucleotides.

RIBOSOMES: These are the factories where amino acids are assembled into proteins using instructions from messenger RNA.

GOLGI BODIES: This is where final touches are put onto many structures, and labels (made of sugars) are added. The labels often tell where the structure should be taken, like a mailing label.

ENDOPLASMIC RETICULUM; This is a series of tubes outside the nucleus and is made of membrane, the same stuff the outer wall is made of. Many proteins start their assembly inside this tube because they will eventually need to be enclosed in a bag made of membrane. The ER puts bags around them and usually sends those bags off to the Golgi bodies for final processing.

Things you find in a cell mainly fall into four categories:

INSTRUCTIONS: This is the DNA or RNA; both are made of nucleotides (sections of "ladder"). The information is found in the arrangement of the amino acids (the pattern they form). The information itself is non-physical and lies in the realm of ideas

RAW MATERIALS: Besides tiny atoms and molecules such as water and oxygen, there are four main types of materials:
1) Amino acids: These string together to make proteins. There are 20 different kinds.
2) Sugars: These are simple sugars such as glucose, fructose, galactose and mannose.
3) Lipids: (fats) These are long chains of carbon atoms, often attached to a "hanger" molecule called glycerol.
4) Nucleotides: These make half a "rung" on a DNA ladder, or a whole rung on RNA. Besides the rung they also have a piece of the side of the ladder, so all you need to do is string them together.

TOOLS/WORKERS: Cells have lots of "gadgets" that are usually made of protein. Some of them function much like tools we are familiar with such as scissors, staplers, folding machines, shredders, motors, vehicles, pumps, keys, clips, and copy machines. Most of these tools need energy in order to operate, just like our tools need electricity, batteries, or muscle power. Cellular tools use rechargeable batteries called ATP (briefly explained in the section above on mitochondria).

STRUCTURES: The instructions, raw materials, and tools are used to build structures. Often these structures are made of protein but can have added features made of sugars or lipids. Many cellular structures function like structure we are familiar with, such as cables, string, walls, , flags, hooks, anchors, mailboxes, letters, labels, walls, bags, tubes, and gates (we did not draw gates).

The division between tools and structures is a bit blurry. (Is a key a tool or a structure?)