FEATURE: What Darwin Didn't Know about Cells

VOICE: We've learned a lot about the human body during the past century and a half. For example, Darwin thought the cell was basically a blob of jelly.

PROF.: Geneticists with scanning electron microscopes have outgrown that simplistic idea. Let's look through the lens to see what's really going on.

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VOICE: In Darwin's lifetime, scientists thought cells were nothing more than tiny building blocks, like bricks in a building or passageways for specialized juices. Some textbooks still make the cell seem like a plastic box containing gelatin with a few pieces of fruit floating inside it.

PROF.: But improved microscopes have shown many interesting details. First, the shapes of various cells differ greatly. Muscle cells are long and spindly, and most nerve cells look like deranged octopi. Skin cells are flattened rectangles, and blood cells are round.

VOICE: In his book *What Darwin Didn't Know,* medical doctor Geoffrey Simmons adds, "Many [cells] are extremely flexible; some can stretch to double their size, and others shrink to half. …Billions ride the currents of the bloodstream everyday – tumbling, surfing, floating, and swimming."

PROF.: He adds, "Some can suddenly latch onto a cell wall as if it were lined with Velcro; others can slip in between cells to fight intruders.

"Some bring manufactured products; others take them away. Certain cells are heavily armed and patrol the blood vessels for signs of intruders. Some make antibodies and communicate with each other to coordinate their attack. Many secrete substances to raise body temperature."

VOICE: What else do high-powered microscopes show about cells?

PROF.: It's not just the ***interior*** of cells that are specialized. Cell ***surfaces*** also have assigned functions. Some have thousands of cilia – tiny waving projections – moving irritants out of the lungs or moving nutrients along the digestive tract. Cells in the inner ear have microscopic hairs that respond like tuning forks to specific notes.

Specialized cells monitor the environment for potentially dangerous chemicals, toxins and allergens. Other cells regulate important details, such as monitoring blood pressure and heart rate, sensing changes in body temperature, or adjusting concentrations of salts, nutrients, and water.

VOICE: How many kinds of cells are in the human body?

PROF.: There are 200 known variations. They range from microscopic red blood cells to long, skinny nerve cells that stretch from the base of the spine to the foot. Some cells ***prevent*** infection. Others ***fight*** infection.

VOICE: So 200 kinds of cells do a wide range of functions.

PROF.: And every cell contains an estimated thousand million compounds. They include approximately five million different kinds of proteins. These proteins can have more than one function or electrical charge. They all know where to go and how to get there, when to do it, how fast to react, and when to stop.

VOICE: Amazing! I've read that cells communicate with other parts of the body, using both chemical and electrical messages.

PROF.: Yes. Certain nerve cells signal pain and heat or cold to the brain, and other nerve cells quickly carry the response back to muscles, joints, and ligaments. Heart cells use electricity to make heart muscle cells contract in unison, and chemical messages from a variety of sources control the heart's speed.

VOICE: Don't chemical messages also tell the thyroid, adrenals, and other glands to speed up or slow down hormone production?

PROF.: Yes. In the section entitled "Cell Components," Dr. Simmons says, "Like an industrial complex, a cell has numerous factories, called organelles. …They all contribute to the making or use of proteins, carbohydrates, lipids (fats), hormones, vitamins, salt, and water."

VOICE: One website contains a comment that the various cells and organs of the body act as if they all know what they need to do to keep the body alive and well.

PROF.: Each cell acts as if it contains an instruction book. Messenger RNA carries the instructions from a gene or genes to the workplace, where workers called ribosomes read the instructions, collect the appropriate amino acids, and begin manufacturing a specific protein or proteins. Somehow these messengers know which genes have the instructions, how to transport them, and where to deliver them.

Similarly, the workers are able to ***read*** the message and carry out the instructions. When the product is complete, it folds itself spontaneously and is loaded onto or into a complex tubular system that delivers it to the proper destination, either within the cell or to the cell's shipping port.

VOICE: Each cell wall seems to know what substances to let pass through it, and what substances to stop.

PROF.: Yes, the cell membrane is solid enough to keep water in and keep intruders out. Yet it's semi-permeable to allow certain nutrients to enter, and to allow wastes to exit.

VOICE: The cell membrane is self-sealing. One can puncture the wall with a microscopic needle, and it will immediately close up. The side facing the capillary – the smallest blood vessel in the body – is covered with loading docks that have various structures to receive a long list of products.

PROF.: Passageways to the cell interior can resemble long hallways, conveyor belts, or sieves. The remaining sides of the cell tightly adhere to neighboring cells by a special glue that is made at the border membrane. In many instances, these membranes can bend, stretch, flex, stiffen, bulge, and retract.

VOICE: Each cell contains several monitoring systems. For example, kidney cells constantly change their hormone production to adjust for salt and water needs. If a cell is injured, it sends a distress call to have it repaired or replaced. If the body is chilling, metabolism increases to increase warmth; if the body is overheating, metabolism slows to allow cooling.

PROF.: Forty or more types of enzymes exist inside a particular set of chambers called *peroxisomes*. Each one has very specific responsibilities – to snip this, attach that, glue those, or speed up some chemical reaction.

VOICE: Some are secreted at specific times. For example, the pancreas activates when food needs digesting. Enzymes know their target, work within a fraction of a second, and then self-destruct.

PROF.: Materials pass in and out of cells in a variety of ways. In some locations, they travel in one direction only; in others there's an exchange.

Specialized cells remove nutrients from the gut, using a particular mechanism for each type of material. White cells surround bacteria or harmful debris. Other specialized cells actively remove waste items from the blood and expel it through the urine.

VOICE: So more than 200 kinds of cells, all have specific assignments.

PROF.: Dr. Simmons says, "Each cell is also a combination metallurgist, pharmacist, and chemist. It handles and stores a number of vitamins, chemicals, and toxic metals and is able to release whichever ones it needs."

He uses the expression, the "whole package phenomenon."

VOICE: If I remember correctly, the "whole package phenomenon" means all the parts have to work together as a coordinated, cooperating unit.

PROF.: That's right. In his words, "Knowing how to store, retrieve and transport these items had to have come about as a…whole-package phenomenon…"

VOICE: It just couldn't be the result of separate systems that luckily came together.

PROF.: That's a good way to express it: "organs organized into an organism."

Dr. Simmons adds, "What remains overwhelmingly impressive is that the single cell can do more than our most powerful computers, that it can be completely different from, yet totally compatible with, its neighbor cells, and that every function is predetermined on a submicroscopic level."

VOICE: There was a lot of information in that one sentence. Please repeat it to help me absorb all of it.

PROF.: "What remains overwhelmingly impressive is that the single cell can do more than our most powerful computers, that it can be completely different from, yet totally compatible with, its neighbor cells, and that every function is predetermined on a submicroscopic level."

And he concludes that often the thousands of millions of results are a domino effect. One development leads to another, to another, and to another.

VOICE: The activities of ***individual*** cells are amazing enough. But the way they ***work together*** is even more impressive.

PROF.: The various processes of the "cellular orchestra" make beautiful music together – because a combination of electrical and chemical "conductors" lead the orchestra.

VOICE: That sentence summarizes our discussion poetically: "The various processes of the 'cellular orchestra' make beautiful music together – because a combination of electrical and chemical 'conductors' lead the orchestra."

PROF.: The harmonious way that these conductors and the individual instruments behave, seems to indicate that there was a Composer who arranged the various cells of the body. This Composer seems very much like the God that the Bible book of Psalms applauds in the words, "I praise you, because I am fearfully and wonderfully made. Your works are wonderful; I know that full well." (Psalm 139:14).

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Primary source:

Geoffrey Simmons, *What Darwin Didn't Know* (Eugene, Oregon 97402 USA, 2004), pages 43-53. Used by permission of the author.