I AM A POND
God Creates Me

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PREFACE

One day I was sitting by Paul's Pond at LOMC. Someone had just drawn water out of the pond into a clear glass vial. Looking at it I could see many types of life teeming in that small wet space. I don't know what possessed me to say it, but out of my mouth came the words, "I am a pond." I became intrigued with the notion: I am a body of water. Like the pond, I have many types of life within me, and my body depends upon these organisms and organ systems to work.

I had hoped that I could find some publications that compared the human body with a pond. Much to my disappointment nothing has surfaced so far. Besides reflecting on God's creative activity in relation to my body, I am making a furtive effort to parallel the pond and the human body.

To begin, the stage must be set by introducing the characteristics of water, an ecosystem, the pond, and the human body.

INTRODUCTION
Water

Water is a phenomenal resource. It touches every part of the earth and appears in a variety of forms. Water sculpts the earth. We can see the etchings of the glaciers and the shaping of the landscape by rivers. Water has the capacity to create serenity and, when it rages, to terrorize.

Three fourths of the earth's surface is covered with water. Water comprises 70 - 80% of our bodies. Cells are made up of 70% water. All of life is ultimately dependent upon water, what it does, and what it contains. Water is the lifeblood of the earth.

In the human body everything that nourishes our cells - nutrients, oxygen, and organic compounds - must arrive via arteries and capillaries and returns via veins which contain blood composed mostly of water. For plants, 100 pounds of water are needed for each pound of new growth.

Water freezes, and therein lies one of its peculiar properties. As water cools, the molecules pack together more densely, like a rock. It becomes heavy and begins to sink. When water reaches 39.2°F (4°C), it attains its highest density. As water cools to the freezing point of 32°F (0°C) its molecular structure gradually expands and becomes less dense. Ice becomes slightly lighter than the warmer water beneath it, and it floats. Because of this, a pond freezes from the top down rather than the bottom up. As a result the heat transfer from the water is reduced, and the underlying water is protected from freezing. This is important for all sea, lake, and pond life. Thus, some living organ-

isms, such as fish, can survive the winter.

Water holds heat well, so it responds slowly to the rise and fall of outside temperatures. Because of this, a body of water influences the area around it, warming and cooling it more slowly as temperatures change.

The water cycle is familiar to most people. Sunlight and wind cause water to evaporate. As a gas water rises from the surface of the earth. When water reaches the cooler air of the upper atmosphere it condenses onto fine particles in the air, e.g., dust, pollen grains, or pollutants, and forms a cloud. When air gets very moist it forms droplets and eventually falls to the earth as snow or rain. The amount of rainfall each year would cover the surface of the earth with water 3.3 feet deep.

More water evaporates from the oceans than falls there as precipitation on the oceans, but less water evaporates from the land masses than falls on it. The rivers act to balance the water between the land masses and the oceans. (Later we will see how the lymphatic system in the human body does a similar thing.)

The circulation of water vapor also serves to distribute heat from the equatorial regions to the northern and southern extremes of the earth. (This is similar to blood circulation that supplies heat to the extremities of the body.)

Another characteristic of water is that the electrically charged molecules of water make it a wide ranging solvent that facilitates many chemical reactions. (This is seen in the ability of water to dissolve many things.)

Basic Characteristics of an Ecosystem

An ecosystem is a community of plants and animals interacting with each other and the environment and sharing available resources within a defined area. Each species has its own niche (profession and place). A healthy community has a great diversity of species. The ecosystem takes into account the biotic (living) and the abiotic (non-living) components of a system and establishes a balance between them.

The ecosystem is energized by a process in plants called "photosynthesis." This process can be shown this way:

water + carbon dioxide + chlorophyl + sunlight
yields
water + oxygen + carbohydrates

Respiration is the way an organism metabolizes food molecules to get energy for growth and maintenance. Oxygen is consumed and carbon dioxide is given off. Healthy ecosystems experience a balance between the levels of activity of oxygen producers and oxygen users.

In most ecosystems there are producers, consumers, and decomposers as

well as herbivores, carnivores, and omnivores.

"Food chain" describes the way the sun's energy passes from one organism to another. The food pyramid represents the energy loss. The food web shows the many possible ways energy flows. The more complex the web, the more stable the ecosystem.

The nitrogen cycle is one of the most critical in the ecosystem. Five percent of the dry weight of every living cell is composed of nitrogen. It composes 79% of our air and is essential for plant and animal growth. Its most useful forms are ammonia and nitrate. This process yields amino acids which later are incorporated into protean and DNA molecules.

Some bacteria on legume roots and blue-green bacteria in water can change nitrogen gas into ammonia. The process is called nitrogen fixing. Lightning also fixes nitrogen for use in the soil. In gas form, nitrogen is unavailable.

Macronutrients are elements needed in an ecosystem in large amounts: phosphorous, calcium, and sodium. Micronutrient are elements needed in smaller amounts: zinc, manganese, magnesium, silicon, iron, and iodine.

All plants and animals have natural upper and lower limits of tolerance to temperatures. Warmer water increases metabolic rates and respiration rates.

Ecological pollution consists of 1) adding a substance that is not naturally occurring, 2) adding substances that increase the amount or intensity of a naturally occurring substance in an ecosystem, or 3) altering the level or concentration of a biological component of an ecosystem. Something must be detrimental to the ecosystem for it to be a pollutant.

Both inorganic matter and organic matter can act as noxious pollutants in aquatic ecosystems. Phosphates and nitrates are common inorganic nutrients that are introduced by surface runoffs from agricultural and domestic fertilizers in lakes and ponds. Organic pollution includes human sewage, waste, and manure. Organic matter contains carbon.

Toxins damage the ability of animals to carry out their life sustaining functions. Nutrient cycles and energy flows are short circuited. Plants and animals have tolerance levels for toxic elements, but if this tolerance is exceeded, stress occurs and resistance to disease and other hazards is lowered. Then there is death. Humans ingest natural toxins daily (about two grams) without harm.

In an ecosystem organisms have several types of relationships. Symbiosis occurs when two or more organisms live together. Commensalism occurs when one organism uses another, but the used one is unaffected. Mutualism is a kind of symbiosis in which both organisms benefit each other. (A good example of this is *Escherichia coli* which is a bacterium in the human intestine, which aids in digestion and is nourished by food consumed by the host.) Parasitism and predation describe relationships

in which one organism uses another organism for its well being and draws nutrients away from it, even causing death. Competition is the striving of organisms for the same limited resources.

In an ecosystem one will find representatives of the five kingdoms into which all organisms fall.

Monera - bacteria - coils of DNA[1] wrapped in a bit of cytoplasm
Protista - one-celled microorganisms that have a nucleus, e.g., protozoa and algae
Fungi - molds and mushrooms
Animals - multi-celled organisms that cannot make their own food
Plants - multi-celled organisms that contain chlorophyll; that use the energy of the sun to make food by photosynthesis

Something needs to be said about the Kingdom Monera because until recently this kingdom had not been distinguished separately from the others. Furthermore, the Kingdom Monera has great significance for this theme.

Bacteria are made of living material called cytoplasm that is enclosed in a sac-like membrane. Most, but not all, membrane-bound cytoplasm, a-re surrounded by cell walls that give it structure. Some cell walls are coated with a layer of loose slime. The walls protect the cell's cytoplasm from drying out. (When we wash our hands, the soap and other detergents dissolve or weaken these walls so that disease-producing bacteria become harmless.)

Bacteria take a variety of forms: spheres or *cocci*, rods or *bacilli*, and helices or *spirilla*. We can see spirochetes and rod bacteria that are found in saliva and in scrapings taken from our back teeth or the bacteria in yogurt and cottage cheese.

These small forms of life are able to divide their DNA equally and pinch themselves in two.

Bacteria move in several ways. Some depend upon the currents of water. Others have flagella that spin and propel the bacteria through fluids.

In the human body and the pond (as well as throughout the whole world) bacteria are essential in the food chain. Their roles are tremendous e-ven though their sizes are microscopic.

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[1]DNA - a nucleic acid composed of nucleotides. DNA is found in the nucleus (control center) of the cell where it constitutes the genetic material, or genes. It has two fundamental roles: it replicates (reproduces) itself before a cell divides, ensuring that the genetic information in the descendent cell is identical. And it provides instructions for building every protein in the body. By providing the information for protean synthesis DNA determines what type of organism you will be and directs growth and development

Pond

A pond is a body of water that has a muddy or silty bottom with a great variety of plants growing from shore to shore. It is smaller than a lake and is usually naturally or artificially confined. No two ponds are alike.

Temperatures in a pond vary throughout the day. The warmer the water, the less dissolved oxygen is in the water[2], and the higher the respiration rate is.

Pond life depends upon photosynthesis. Photosynthetic plants and autotrophic bacteria are primary producers of organic matter in the pond. The major photosynthesizers are algae. Most animal life either eats it directly or feeds on smaller animals that eat it.

Pond mud is mostly saturated with water and devoid of oxygen. Few fungi and bacteria are able to survive in anaerobic (without oxygen) conditions. Thus, organic matter accumulates. Some anaerobic bacteria are chemotropic, i.e., use chemical reactions to derive organic nutrients for growth from inorganic elements. By-products are hydrogen sulfide which smells like rotten eggs, and methane a marsh gas, colorless and odorless but highly combustible. Nutrients are released through excretion and elimination by algae, microscopic animals, and the animals that feed on detritus (the waste at the bottom of the pond).

Water is liquid soil. When water is more fertile, there is a greater abundance and growth of animals and plants.

The relationship between pond water chemistry and nutrient levels is dynamic. Nutrients tend to be more available at certain acidic and dissolved oxygen levels and temperatures. Nutrients such as calcium and magnesium can moderate the acidity of water by acting as buffers that neutralize acids.

The pond is a zoo. It contains representatives of all the kingdoms.

Kingdom Monera - This is the kingdom of bacteria. Obviously, the pond is full of all types of bacteria. However, there is one type that stands out and needs further mention. This is cyanobacteria (blue-green bacteria), once called blue-green algae, one of the most valuable organisms on earth. It photosynthesizes and releases oxygen. Each of the cells looks like it has a coat of gelatin. When grouped together they look like a string of beads or a mass of tangled threads. These can be found on submerged rocks or growing as free-floating mats on the top of the pond. In polluted ponds phosphates and nitrates can be held

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[2]This is true for gases in general; as the temperature of the solvent increases the solubility of the gaseous solute decreases. (This explains why warm pop goes flat. The "fizz" of the pop is due to bubbles of carbon dioxide dissolved in the liquid. As the pop warms, the dissolved carbon dioxide comes out of the solution and the pop tastes flat.)

in this material.

Kingdom Protista - There are several pond organisms in this kingdom. The first is algae. Algae are everywhere. These protista do not grow from seeds. They simply divide themselves. All algae contains chloroplasts which are containers for chlorophyll, which produces food through photosynthesis with oxygen as a by-product. What food alga does not use for itself is stored as starch (like rice and potatoes plants do). Over 6,500 types of green algae have been identified. Some algae have flagella to propel themselves and others fasten to stones.

Another member of the Protistan kingdom is the diatom. Over 5,000 types of diatoms have been identified. Each diatom lives inside a tiny crystal box made of silica. There are two types: one looks like a crystal bicycle reflector and another like a rowboat. When diatoms die they sink to the bottom of the pond and create a sediment called diatomaceous ooze. When this ooze dries up it is called diatomaceous earth which is used in pool filtering systems.

Amoebas are in the Protistan kingdom, too. The typical pond amoeba is *Amoeba proteus*. It is about the size of a pinhead. Its cell consists of liquid cytoplasm that is held together with a tough outer membrane. The material looks like tiny grains of sand. It is bound together with a jellylike layer. The amoeba moves by sending out a "foot" which looks like a finger in a rubber glove and then the body flows into the finger (or "foot"). When the amoeba finds food it releases a number of the "feet" to surround the food. The food is enclosed in a small bit of the amoeba's cell membrane, like a tiny balloon, with the food inside. There the food is digested and absorbed directly into the amoeba's body. Like protozoa the amoeba takes in carbon dioxide from the water through tiny openings in the cell membrane.

Ciliates are also in the Protistan kingdom. They are fast moving. (Note the name "cilia" is the word for hair found on and in the human body.) Cilia resemble eye lashes connected by a network of fibers that work in unison like many oars in a racing boat. Over 8,000 different ciliates have been discovered. They are found eating bacteria in decaying matter. They also eat algae and other protozoa. It has been estimated they can consume 2-5 million *Escherichia coli*, the common intestinal bacteria, every day. The most common ciliate is the *Paramecium*. It looks like a tiny gray speck in the water. One type of ciliate is the *didimiums*. It is the wolf pack of ciliates. It eats only *paramecia*. Another ciliate is the large stentor. It is shaped like a trumpet. Other ciliates are the *Vorticella* which are shaped like a bell, *Colpidium* which are shaped like a kidney bean, and *Bursaria* which look like a change purse.

Animal Kingdom - First are the Rotifers - the wheeled animals. Most are free-swimming. The one most commonly found is the *Rotaria rotatoria*. Its body is cylindrical, and its head bears the wheels. Rotifers have a nervous system, a brain, sense organs, muscles, organs that float within the body cavity, and fluid that acts like human blood. The Rotifer consumes bacteria, protozoa, and algae. Rotifers are mostly female.

They lay eggs that hatch without male fertilization (parthenogenesis).

Tardigrad - Water bears. They move along the bottom of the pond with eight stumpy legs that end in hooks. To eat they suck out the contents of plants. They conserve energy when in a stressful situation by drying up and shriveling their body into the shape of a barrel.

Arthropods contain the most complex invertebrates (no backbone) known. In this phylum are Crustacea, Arachnida, and Insecta. The Crustacea include large crabs and lobsters, small water fleas, water hoppers, and seed shrimp. Water mites belong to the Arachnida (along with spiders).

Water fleas (daphnia) and water hoppers (copepoda) need to be highlighted because they are so common in most stands of water.

Water fleas are among the smallest members of the Crustacea. It resembles a flea only in the way it moves in the water. At the top of the daphnia's head there are what look like branching arms. These are antennae and are used for swimming. Daphnias favor algae for food. The water fleas have a visible heart which pumps blood around the interior of the body.

Water hoppers have two sets of antennae. The first antennae curve out on either side of the creature's head. The second antennae are smaller than the first and fold against the body when moving in the water. With this antennae and four pairs of legs the water hopper swims. The most common copepod is the Cyclops. Its gets its name from the single eye in the center of the head.

There are also many other animals, which are called zooplankton, that could be named, e.g., sponges, worms, etc.

When one sees with amazement the microscopic life in a pond, one begins to wonder about all the life within our own bodies.

Water in the Human Body

The human body is 70% to 80% water. Water is present in blood, lymph (a Latin word that means "water"), mucus, and saliva (needed for taste and smell).

Grey matter in the brain contains 85% water. Other tissues, such as fat layers, contain 25%. The body's major transport system is the blood which contains 80% water.

The control center for thirst is in the hypothalamus, which is deep in the brain. This organ senses the amount of water in the blood. If the amount of water in the blood compared to the amount of salts and other substances diminishes, the nerve cells in this organ are stimulated. In addition to creating the sensation of thirst, this organ guides production of hormones which make the kidneys conserve water. The kidneys manage the water balance, which must be kept within very tight limits.

The plasma in blood is a water solution of minerals, nutrients, and small amounts of essential compounds such as hormones plus one other essential component - the protein that makes up a major part of the plasma.

Mucus is an essential part of several organs. In many cases the activity of the organ involves acid which could destroy the organ. In a sense, mucus can protect the organ from itself.

Water is eliminated from the body by breathing, sweating, urinating, and defecating (as well as sneezing, spitting, and regurgitating).

In the eye the image of an object being seen passes through a watery liquid (the aqueous humor) that is inside the corneal dome. The ear uses a fluid called endolymph to maintain the body's balance.

Each and every cell in the human body contains water and is bathed in water. Water transports all the sustaining substances. Even saliva brings nutrients to the teeth so they will remain healthy and not become chalky.

Amazingly enough, the body makes water any time stored protein or carbohydrates are broken down.

In days of old the word "humor" was used for certain liquids in the body: blood, phlegm, choler, and melancholy. The latter two are types of bile. Phlegm is mucus. People's dispositions were thought to be determined by the condition of the humor; a person could be in good or bad humor.

Human Body

To best understand how the human body works we are going to look at some of its systems, in particular, the ones that closely ally themselves with a pond.

DIGESTIVE SYSTEM

When we consume food our bodies immediately begin to digest it. Meat, vegetables, fruits, and grains do not retain their original form very long. Digestion in the body is accomplished by enzymes and bacteria. They break down food into nutrients. The nutrients that result are amino acids from protein, glucose from sugar and carbohydrates, and fatty acids from other carbohydrates. They eventually become small enough to travel through the smallest of the blood vessels in our body.

How does this happen? Most food we eat we chew. We break down already small pieces into smaller pieces. Why don't we swallow the food whole like a snake swallowing a mouse and let all the enzymes, bacteria, and acids do the work? The reason is that these digestive materials only work on the outside of the particles of food. Mammals, including humans, need to transfer energy from the food to the body rapidly. Teeth break down food into smaller pieces. Snakes do not have teeth because they do not need to transfer the energy from their food as

rapidly as mammals because they are cold blooded.

Saliva (mucus) then comes into play. It has three functions. First, it gives us the ability to taste what we are eating. (Taste and smell are chemical reactions created by molecules and mucus.) This is important for sorting out good food from bad. Second, enzymes in the saliva begin to digest the food. Third, saliva mixes with the food so it will be easier to swallow providing lubrication.

In swallowing, the food passes through the esophagus and on to our stomachs. There the food encounters more things that break it down: hydrochloric acid (which will eat your skin if it touches you), the enzyme pepsin that comes out of the walls of the stomach lining (the fancy word for that process is secreting), and bacteria. The mixture of all these things is called chyme. After about four hours in the stomach the chyme passes into the small intestine (where it spends another 4.5 hours).

In the small intestine food is digested by more enzymes and bacteria. In fact, the resulting particles are so small that they are absorbed into the walls of the small intestine. (Remember how the amoeba is fed?)

The walls of the intestine are peculiar. They are not a flat surface or plane and even surface as one might think. These walls look like thousands of fingers being poked into a membrane of some kind. Thus, the wall has a very great surface area.

Not all the chyme is absorbed into the walls. The particles that are too large and have no nutritional value continue their journey into the large intestine where the water is drawn out. Water and undigested food spend 7-16 hours in the large intestine. The liquid eventually becomes urine, and the solid material eventually becomes feces.

Let's get back to the small intestine. What happens to the nutrients that pass through the walls of the small intestine? They are absorbed into the veins that pass through and around the intestine.

Eventually we will talk about the circulatory system, but suffice it to say that the blood vessels, the arteries, and capillaries that carry oxygen from the heart and deliver the oxygen throughout the body, become veins as they return the deoxygenated blood (that now carry carbon dioxide) back to the heart where it eventually will be brought to the lungs and exhaled. These are the veins that are all around the small intestine.

It is into these veins that the nutrients from the small intestines are absorbed and carried directly to the liver. In the liver the nutrients are broken down further, and any impurities are removed. The fat is m-etabolized in the small intestine by the bile that is produced by the liver. The hydrochloric acid from the stomach is neutralized. The end result is ammonia, which is removed from the urine by the kidneys. Vitamins A, D,, and B, and iron are also stored in the liver for use

later when certain stresses are placed upon the body. The liver metabolizes drugs and alcohol, as well.

Once through the liver, the deoxygenated and nutrient-carrying plasma travels in the veins to the heart, to the right ventricle. This is then pumped through the pulmonary artery into the lung where the exchange of carbon dioxide and oxygen takes place. The blood, now saturated with oxygen, returns to the heart, the left ventricle, and is pumped into the aorta which then distributes it throughout the body.

What might confuse people is how food that enters the mouth can become so small it can pass through various membranes of the body.

We need to understand that the enzymes, acids, and bacteria in our bodies break down food to the basic substances: glucose, fatty acids, and amino acids. The amino acids are the building blocks of proteins. This process is the magnificent work of the liver.

RESPIRATORY SYSTEM

The lungs draw in oxygen. Oxygen is carried by the blood and is used to "burn" the sugars of our body into useful energy. When the oxygen is spent, the red blood cells absorbs the carbon dioxide in our cells, and the carbon dioxide is taken by the veins to the lungs where it is exhaled into the air. In a plant this carbon dioxide finds its way back to a leaf where photosynthesis takes place, and carbon dioxide is converted into sugar and oxygen.

CELLS

To best understand how the body works we need to learn a little about cells. All living matter is made up of cells. The human body contains many types of cells such as: muscle, pancreas, ovum, bone, blood, liver, heart, lung, kidney, skin, nerve, and brain. There are many more.

The human body is composed of trillions of cells. WOW! All these cells have different functions, and they make up all the organs in our body. All the cells in our body have one thing in common: each cell in our body has our own personal name - a scientist would call it a code. In fact, it is our unique DNA. Whatever it is called, each cell belongs to us.

These cells are incredible. They are 70% water (sound familiar?). They have within themselves all the blueprints necessary to duplicate our complete body. How's that? By whatever process one wants to call it, each cell has taken on one particular role in our bodies.

Our cells can reproduce. They have various life expectancies. Some cells do not reproduce: heart muscle cells, egg cells, cartilage cells, and neuron cells. The cells that do reproduce vary in their duration of existence. Here are some examples:

Stomach lining	2 days
Platelets	10 days
Olfactory cells (scent)	60 days
Red blood cells	120 days

Skin cells	1-34 days
Sperm cells	2-3 days
White blood cells	Few days to several months
Liver cells	500 days (can replace itself entirely)
Bone cells	25-30 years

The surface of our skin is essentially dried-up cells. These cells flake off our bodies and are probably one of the greatest contributors to house dust.[3]

While cells are alive they need to be nurtured. That is what the blood does. It brings water, oxygen, and nutrients so the cell can live.

CIRCULATORY SYSTEM

Because the organs are so integrated the circulatory system was reviewed when covering the digestive system. However, we need to go a little further. Blood, which some refer to as a separate organ, transports many things: red and white cells, platelets, dissolved nutrients, and hormones. Blood is carried through a system of blood vessels. There are 62,000 miles of blood vessels in the average human body. These blood vessels make sure that all the parts of our body are fed. Also carried in the blood vessels is the material that keeps us well through our immune system.

The red blood cells; hemoglobin, which binds up oxygen; and platelets are manufactured in bone marrow. White blood cells are generated in bone marrow and the lymph glands.

The heart pumps blood into the arteries about 70 times per minute. The pressure travels along like a wave. This wave is our pulse. The heart pumps blood around the body in just 30 seconds.

LYMPHATIC SYSTEM

One of the fascinating systems in our bodies, with which we may not be very familiar, is the lymphatic system. This system plays two roles: 1) transporting fluids that have escaped from the blood vessels back to the blood and 2) defending and resisting disease. Actually, we know something about this system because we might know about tonsils, adenoids, and lymph nodes (the ones that swell up when we have mumps). Lymph is excess water in our bodies that is produced by all the cells in our body.

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[3]The skin is the body's largest organ, 15% of our weight, and is the body's first defense against microbial invasion. A piece of skin the size of a dime contains two hundred nerve endings, ten hairs and muscles, one hundred sweat glands, fifteen oil glands, three blood vessels, twelve heat-sensing organs, two cold-sensing organs, and twenty-five pressure-sensing organs. The skin is composed of three layers: an outer epidermis, a lower dermis, and an underlying layer of subcutaneous tissue.

Just like blood running through arteries and veins, lymph runs through a vessel system. Lymph does not flow like blood. Blood is pumped from the heart- it spurts. Lymph, on the other hand, is exercised through the lymph vessels by the movement of our muscles.

The water that passes through our bodies into the lymph vessels can be infected. Many pathogens are collected in this water. When the lymph passes through the lymph glands, the lymph is filtered and cleaned up with white blood cells. Lymph nodes swell and "get infected" when they are fighting off infections in the body with white blood cells. Once cleansed, the water is passed on to the heart where it re-enters the blood stream. The lymph system is a part of our immune system.

EXCRETORY SYSTEM

This is probably the disgusting topic. Who wants to talk about human waste? Yet, the body needs to rid itself of various things that are toxic or of organisms that are no longer useful. Cells that are replaced, for example, need to be discarded.

Humans excrete in four separate distinct ways. First, there is sweat. There are certain toxins that are detoxified in the liver, and they are expressed from the body through the pores as sweat from the sweat glands.

The second process is breathing. Remember that the lungs exchange carbon dioxide for oxygen in the blood. Carbon dioxide is a by-product created when protean, fats, and sugar are burned, and it is toxic to the human body so it is expelled in exhalation. Water is also expelled. Breathe on a piece of glass.

The third is urea. The liver breaks down the amino acids to urea which is excreted and glycogen which is stored for later use by the blood for energy. We create about 3½ pints each day. Ammonia is also a product of breaking down food in cells (metabolism).

The fourth is feces. Various foods that the body does not break down, hormones, used-up cells of various types, and bacteria are excreted as feces.

There are five major sources of bodily waste products: toxins, internally produced chemicals, food, nitrogen, and fibers (which makes up the bulk of the feces).

The kidneys are a major participant in the blood's excretory system. There are two of them. Blood passes from the aorta through the renal artery, is filtered by the kidney, and passes out through the renal vein. The kidneys absorb useful molecules and reject unwanted waste that is expelled through urine.

In 24 hours the kidneys filter 47 gallons of blood derived fluid. Ninety-nine percent of it is returned to the system, and 1% is expelled.

The Glands

The glands in the body manufacture chemical substances called hormones. The word hormone comes from a Greek word meaning "to excite," and that is what hormones do. They excite or stimulate various parts of the body to function properly. Some glands send these hormones directly into the blood stream and so are called ductless or endocrine glands. The other type, like the pancreas, have little tubes or ducts through which they send out the hormones and therefore are called duct or exocrine glands.

To keep the body working normally, these glands must be regulated so that just the right number of hormones are released. The pituitary gland, located in the brain, is the most important gland.

Besides making hormones, the pituitary gland directs and controls all the other glands such as the thyroid, parathyroid, adrenal, etc.

Consider the thyroid gland. It produces thyroxin, which is needed for proper body growth and mental development. The thyroid gland sends out thyroxin to protect the body against abnormal mental and physical development.

All the hormones together regulate digestion and the changing of the food we eat into useful nourishment needed to rebuild cells - a process called metabolism. The hormones also regulate physical maturity, reproduction, and some mental ability.

Chapter 1
I AM A POND

In the Bible humans are likened to trees, grass, chickens, sheep, deer, goats, and grasshoppers. But nowhere in Scripture is the metaphor of a pond utilized. Thus, we are venturing out on our own.

The pond metaphor is intended to help us understand ourselves as an ecosystem. This particular image of an ecosystem and how it works is of recent origin in human thought.

Scripture does talk about water. The spirit broods over the water at the beginning of the first creation story in Genesis. In John Jesus is called the "living water." Water is the element in baptism. Water is a symbol of dying, drowning, cleansing, and satisfying thirst.

Water is a major subject in the environmentalists' Psalm 104. However, at no point in Scripture is water seen in the same details as we will be looking at it. Water for us will be the medium in which life takes place. Water is the place where organisms in a pond carry out life's functions. Water is the transport system for the activities of the organs of the body.

An interesting characteristic of water is that it touches all of time and space.

CELEBRATE WATER

Warm water soothes me
Yesterday touched a head in baptism.

Fresh water quenches my thirst
Tomorrow will cool a fevered child.

Soft droplets punctuate solitude, striking my umbrella
Yesterday aided spring flowers to push up and smile at the sun.

Rain water nourishes a thirsty pond
Tomorrow will keep seafaring vessels afloat.

Clear water trickles down a mountainside
Yesterday - mudpies!

What does it mean to you to look at yourself as a pond? There can be some fascinating responses.

First, both the human body and the pond depend upon the gas exchange. For humans, oxygen enters when one inhales and carbon dioxide leaves when one exhales through the lungs. Oxygen is introduced into the pond through the algae and plant life in it as well as by the wind blowing, exciting the water surface, and allowing oxygen to enter the water. In both the human body and the pond oxygen is introduced, and various organs and organisms release carbon dioxide.

In the pond oxygen is dissolved in the water. It does not create a separate chemical structure. In the human body oxygen is absorbed in the hemoglobin and becomes a part of another chemical structure.

Second, the nutrient cycle is a continuous activity in both the pond and the human body. The difference is the major players. In the body they are both the organisms and the organs, and in the pond, the organisms.

Third, throughout the human body there are enzymes, and specifically in the intestines there are bacteria. All these are necessary to break down food. The idea that there are millions of microbes in our bodies may sound unsavory to us. Nonetheless, they must be retained for our good health. Bacteria and enzymes are also a critical part of the pond system for the sake of digestion. They are free agents in the water as well as at work in the various organisms. They also play a critical role, along with fungi, in the digestion of excrement that coats the bottom of the ponds.

Fourth, the body has skin with a variety of animals living on it. Be sure to look at Knudsen's book, Furtive Fauna. The pond has skin, too. It is the surface tension of the water. Some critters such as water striders move on it. Others live under the surface of the pond, such as larvae for mosquitoes and dragonflies.

Fifth, the pond and the human body have a circulatory system which

maintains appropriate temperatures throughout the system. The human body works most efficiently at 98.6° F.

Sixth, the human body and ponds age.

In making this comparison we can learn that the body is an ecosystem that has its own integrity.

There are also certain things that distinguish a pond from a human body. One stands out with great significance. In a pond, relationships between organisms can be antagonistic, i.e., the predator/prey relationship, which are part of the food chain. In the human body, continuity is the nature of the relationships of the organs, i.e., they are more symbiotic.

Chapter 2
GOD CREATES ME

Christians believe that humans are products of God's creativity. For some individuals this idea is a past tense activity. In reality we are continually being created.

God's creative act is a detailed act. In the book of Job (chapters 38-39) the Lord points this out. In I Corinthians 12 Paul mentions the interaction of organs in the human body. It is recent scientific discoveries that have made us more profoundly aware of the intricacies of the human body and with that the magnificence of God's creative work.

When we say, "God creates me," who is the "me?" There are many living things in my body; thousands and thousands of different types of bacteria and a massive variety of cells. "Me" takes on a little different meaning.

Knowledge of microbes which began in 1678 when Antoine van Leeuwenhoek invented the microscope enabled scientists to recognize cells. (The word "cell" gets its name from the early studies of a piece of cork. The small particles in cork looked like a cell, the rooms in which a monk lived.) The ability to see life in very small forms help us understanding of the uniqueness of our physical world in general and ourselves in particular.
An article in the Science Section of the New York Times, October 15, 1996, titled, "Body Houses Microbe Zoo," shows how far scientists have come in the study of life within our bodies.

> It is a love affair that begins at birth: the human and the microbe.
>
> The human fetus, before birth, is both innocent and germ-free. Skin, mouth, and gut are all sterile. But it is a dirty world, and the adjustment to it starts as the newborn passes through the birth canal . . .
>
> This is when bacteria jump on board. They are in the air, on the

> hands of every person who touches the baby, all over the mother's nipples and the rubber nipple of every milk bottle. In the first few months of life, the infant is colonized by successive invasions of microbes. In fact, . . . at least 400 species begin to set up housekeeping in the baby's gut and many more reside on the skin, the mouth and elsewhere.
>
> But this is not a horror story. Only a few bacteria out of thousands of known species in the world are virulent threats to human health and welfare. The ones that colonize human bodies are, for the most part, working on the host's behalf. And in the most subtle and intriguing ways. . . .
>
> The body's bacterial colonies are among the most dense in nature. Half the contents of the colon are bacterial. Every year each person excretes his or her weight in bacteria. In fact there are very few places in nature where one can find populations as diverse and numerous as ones found in the human body . . . It is estimated that the number of microbes that colonize the body exceeds the number of cells in the body by twofold to one hundredfold.

It may be wrong to talk about "me." Rather we should say "us." Because there are all kinds of "me's" that God creates, and God creates how these "me's" live in relationship with one another. The human body is in fact a diverse community.

Also, in this diverse community there is always flux. Life is being regenerated and recreated

One of the fascinating teachings of the Hebrew Bible is the name used for God, YHWH (Exodus 3). The word can be translated "I am WHO I am," "I will be WHO I will be," "I was WHO I was." The word is grounded in the idea that God is eternally active in all the affairs of life. One should note that it is a word the Hebrew people do not utter out loud because it is sacred. They substitute by speaking the word "Adonai" which means "Lord." Also, one should note that the second commandment instructs us not to abuse the name.

The God in whom we believe is an integral part of natural history as well as human history. God always creates.

Chapter 3
I AM SACRED (BALANCED)

We are temples, places where God dwells, sacred vessels, as Paul tells us in I Corinthians 6:9. He lays it out very distinctly in Romans 12:1-2:

> I appeal to you therefore, brothers and sisters, by the mercies of God, to present your bodies as a living sacrifice, holy and acceptable to God, which is your spiritual worship. Do not be conformed to this world, but be transformed by the renewing of your minds, so that you may discern what is the will of God--what

is good and acceptable and perfect.

What is good, acceptable, and perfect can also be defined as balanced. Other words used to describe a body in balance are sacred - holy - whole - healthy. We can choose behaviors to live with our bodies like we can choose to live with the whole environment.

On the other hand, we can choose to be destructive and live against our bodies. Using the word sacrilegious we can explore how our behaviors are characteristic of temple robbing (the meaning of sacrilegious) where un-balanced behaviors can lead one to dis-ease.

In the introduction there is a discussion of how a pond can become imbalanced. This is through no fault of the pond. A pond has to live with what it is given. But think for a moment how humans can disrupt the balance of the body with the use of alcohol, drugs, tobacco, and poor diets and what Paul calls "the works of the flesh" (Galatians 5). These actions and product consumption are voluntary acts on the part of humans. Not only does it challenge the body's ability to repair itself both mentally and physically, but it can also destroy body parts affected by misuse. Possible mental and physical complications are:

- lack of self-esteem - one only sees one's place in society as a conformist.
- brain damage - affected areas of the brain are dead, shutting down cognitive capabilities.
- intensive lung inflammation - white blood cells work overtime to stimulate production of antibodies to bring it back to health. If the problem persists, the white blood cells cannot do any other job.
- chronic bronchitis - air tubes are infected robbing one of needed oxygen upon which the body depends.
- weakened immune system - white blood cells are too busy to work throughout the body.
- lack of energy - body systems denied proper nutrients

In Galatians 5 "the works of the flesh" are fornication, impurity, licentiousness, idolatry, sorcery, enmities, strife, jealousy, anger, quarrels, dissensions, factions, envy, drunkenness, carousing, and other such behaviors. The word, flesh, for such behaviors is a result of one not seeing oneself as a vessel of the Spirit of God, a temple, a place where Christ dwells. Ironically, humans have a natural tendency to be sinners whom God continually revitalizes. This does not give humans the right to choose sinful behaviors, but to create healthy strategies to "present our bodies as living sacrifices, holy and acceptable to God." As Paul writes in Romans 6 we are to "consider ourselves dead to sin and alive to God in Christ Jesus."

Christianity has to do with our attitudes, our love of others, our faith in Christ. It also includes our physical selves.

The way we look at ourselves begins with our baptism, the water sacrament of rebirth that makes us new people, new creations, new beings. Our whole selves belong to the order of God's plan of salvation, God's

plan that humans be balanced, that our bodies be sacred vessels of God's presence in the world.

Chapter 4
I LOVE MYSELF

You shall love your neighbor as you love yourself, Scripture teaches. This means we should extend to our neighbors the way we treat ourselves.

It might be that you have a little different appreciation of this concept having reflected a little on the self as an ecosystem. When we love ourselves we are loving the sum of many parts, organs, and organisms. Self love is seeing to it that each part of the self is doing what it is supposed to do. It is a community affair.

The opposite of self love is egoism or egotism or egocentrism. We put ourselves at the center of the orbit as though we are the sun.

The love of self is an altruistic and mutualistic act, not only for the community within us but the community outside of ourselves. If we do not care for ourselves we put others at risk.

My wife shared an example from her work place. People throughout the office had colds and spread germs every time they sneezed, passed a piece of paper, or touched community property. Rather than staying home and nursing themselves back to health, they were at work. It was a contagious environment. Everyone was affected.

Another example of this insight is the spread of the HIV and AIDS. Because people have been careless about themselves and how they interact with others, it has become necessary to treat as though each person is HIV positive. A person doing simple first aid must wear gloves when treating a victim lest they come in contact with body fluids. No one knows if another is infected.

A way to understand the self in this context is to understand the pond as a system that is part of a larger system. The trees that grow on its edge are nourished by the water from the pond. The water that flows from it goes to other water courses. Animals which live near or above the pond will use the pond for water and food. Certain bugs develop in their larval stage in the water before they exit the pond water (e.g., mosquitoes).

The boundaries of a pond are beyond its watery limits, just as our boundaries ripple beyond our bodies.

The fact that our bodies are part of a larger system is probably not as apparent. One example is that, like the pond, the human body evaporates and dispels water beyond itself. By this we affect the temperature and humidity of the area around us. We make a physical impact.

What are some of the ways we can care for our physical selves?

a. Correct bad habits
b. Have regular medical checkups
c. Modify behavior that risks our bodies as well as the bodies of others.
d. Control our diet
e. Exercise

Personal hygiene can be practiced. Of all the parts of the body that need cleaning, two of the most important are the hands. We carry more germs to others with our hands than we do breathing or touching objects with our lips.

The physical self must be loved for the care of the community around us.

Chapter 5
I GIVE MYSELF PERMISSION TO BE RESPONSIBLE

If we love ourselves it follows that we would take responsibility for the care of ourselves. I want to look into responsibility in more detail and, as the chapter title states, explore responsibility as something I give myself permission to do. It is a willful act that requires an educated response. I want to demonstrate this with the engaging story of vaccines.

Most everyone has been vaccinated. It is usually a major childhood t-rauma. Vaccinations are given for smallpox, diphtheria, polio, etc. Do you know why we are vaccinated? Do you know what happens in our bodies?

In the late 1700's Edward Jenner had patients ailing from smallpox. Like a good physician he sought a cure. During his research he discovered that the population of people who did not suffer from smallpox were those who worked with cows.

What did these people have that made them immune to smallpox? They had cows and, more specifically, these cows were diseased with cow pox. They had blisters. Pus, that awful stuff that oozes out of blisters, contained the germ of the cow pox. As the people worked among the cows and rubbed against their bodies, the pus would get on their hands and eventually into their open cuts and bruises. It was this pus from cows that made these people immune to smallpox.

It sounds awful, but do you know that because of this discovery smallpox has been eradicated throughout the world? From the time of Jenner scientists have been learning how our bodies fight invading germs and have developed a variety of vaccines.

Oh, yes, the word "vaccine" comes from the Latin word for "cow."

How does a vaccination work? Our bodies have bacteria and white cells

that are always fighting all kinds of infections.[4] The struggle goes on every moment of our existence without our knowledge. When we eat, drink and breathe we take in all types of pathogens that can make us sick. Viruses and bacteria in our bodies are always attempting to perform this dangerous act.

In addition to the white blood cells and bacterium there are also "B" cells and "T" cells. These are unique. "B" cells are created in the bone marrow. "T" cells are produced in the Thymus (thus the "T").

What happens is that when an invader enters the body which the present immune system cannot fight the "B" cell creates an antibody that specifically identifies (i.e., tags) the antigen. It is then that the "T" cells come along to destroy the antigen. This antibody now exists for this specific antigen and travels throughout the body looking for this antigen to appear again so it can "tag" it and thereby alert the "T" cells to destroy it. Thus, our bodies are immune to that particular antigen.

Vaccines are used to make us immune to specific antigens. When we are vaccinated smallpox, an antigen from cows, is put into our bodies. The "B" cells in our bodies recognize the enemy and begin to manufacture antibodies to destroy it.

Vaccines are used to make the human body immune as a preventive maneuver. An antibody "learns" about a specific antigen and fights it off. It "remembers" this antigen. The next time that particular antigen enters the body the specifically designed antibody chases it down and summons "T" cells to destroy it.

The fact that the body has the capacity to heal is taken for granted when we get a cut on the skin or break a bone or develop a cold. This is when we notice the healing process taking place. Our antibodies, the bacteria that line our bodies inside and out, and our white blood cells are always fighting disease. This is the immune system at work.

When one studies an ecosystem it is apparent that all of the natural world have the built-in capacity of responding, making whole, and nurturing, if for no other reason than for the selfish benefit of the organism. Creation is always being restored. This restoration is the work of the system and not simply the activity of an individual organ or organism.

Restoration can be observed over long periods of time in a pond. Ponds that have been degenerated have the ability to return to their original state if given a chance. This is called resilience. Also, a pond does have resistance to invaders much like the human immune system. A key to this is the pond's biodiversity.

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[4]Imagine how long raw beef takes to rot. This is what would happen to us if our bodies did not fight back.

Now I want to shift gears. When we talk about ecosystems we need to also address the human influence on the environment. Unlike other organisms humans have impacted the nonhuman world to alter its destiny. When it comes to our bodies the situation is no different.

I want to contrast the human act of responsibility with the way an antibody responds. Like the antibodies in our systems humans may know intuitively or may have learned how to be responsible. But being responsible is not always an automatic response. We need to be told, or reminded, or reprimanded.

What is the source of the problem? Some would say that humans have free will and have the capacity to make choices. In a sense this makes humans unique from other organisms. Humans are more complex and have a variety of choices, attitudes, moods, and interest with which to deal. We are not fixed on one task or limited with our talents. We can alter our environment dramatically.

One could say that we are the opposite of antibodies. Each antibody has a specific task, however, there are so many of them, and they are so diverse that by working in community they are able to accomplish the larger task.

The contrast between the human and the antibody should be obvious. For the human diversity us often seen as a bane rather than seen as a blessing. We do not have singleness of purpose within ourselves. The options in our environment are many.

In most cases antibodies are self-tolerant and not destructive to good tissues. But there are some incidents when this is not true. There are autoimmune diseases that occur because killer cells identify body organs as invaders. These "T" cells attack good tissues and cause such diseases as diabetes, lupus, and arthritis.

Humans can be indifferent to or ignorant of the extent to which we go beyond the limits of our bodies. We will willingly destroy the tissues of our very own bodies.

Our memory tends to disappear or become sullied. We may have learned what we are to learn, but it has remained on the surface. It does not become ingested into our response mechanism.

What do we mean by human responsibility?

The concept of responsibility presupposes at least three things. First, the human being is responsive. We can react. A stimulus has a response. Second, the human has an intellect. Information can be sorted out and interpreted in our minds. Third, the human being can take action.

I think responsibility is defined in five different ways, and each of these are facets of a larger definition: recognition, knowledge, timeliness, the welfare of self and others, and judgment.

First, being responsible means we are able to recognize something. We are alert. We notice. There is a consciousness of something outside of ourselves. Once in a while a small group leader will say to a child, "Why aren't you responsible? Don't you see your underwear on the floor?" The child might respond by asking, "What floor?"

Second, responsibility is defined as having knowledge. The small group leader says to the camper,"Why can't you be responsible? I showed you how to set up the tent so it wouldn't blow away." Sometimes we are irresponsible because we don't really know what to do, even when we recognize a problem.

Third, responsibility involves a time factor. When someone does not jump to address an urgent need someone might say they are being irresponsible.

Fourth, responsibility takes into account the well being of the people and the environment. If a person acts in a disruptive manner that person is accused of being irresponsible. On the other hand, if care and concern are demonstrated the action is interpreted as appropriate.

Fifth, being responsible means to use "good" discernment. One must decide then act.

My intention here is not to present a treatise on responsibility. I feel we need to understand that responsibility involves a variety of definitions, and they all fit together. Also, we need to understand that responsibility involves the managing of ourselves, our bodies, our very beings. We have authority over ourselves.

I am encouraging the reader to think in new terms, and I put it this way: I give myself permission to be responsible. The Latin word for "giving permission" is "leisure." We have so abused the original meaning of the word leisure that we might not be able to redefine it. In common parlance leisure is treated as recreation. time not working, or lounging around and sloughing off. We need to shake off that usage.

We give ourselves permission to do a lot of things. In some instances, which tend to be dramatic, they are negative behaviors. But there are positive ones, too. We permit ourselves to work and to play. There are times we will say we deserve something because we have done something to earn it. We really mean we are giving ourselves permission.

Giving permission is an effort, an intentional act. It is an independent act. It can certainly be encouraged by peer pressure. But what it ultimately boils down to is that the granting of permission is something I do on my own and for myself.

To give myself permission to be responsible cuts to the chase, and we are freed to act, not just to decide.

The focus of this paper has been on God continually creating our bodies to make us whole and the plan is that we participate in our own health

maintenance.

Let me summarize how I think a Christian person should be grounded when making decisions regarding their well being.

1. What is the image of our physical self? I have suggested the pond metaphor. Do we see ourselves as individuals or as communities?
2. How do we understand God's continual creative process in ourselves? Or do we think we have been made and thrown out to fend for ourselves?
3. What message(s) do we convey with our bodies in the world? Are we temples of the Holy Spirit or examples of sacrilege?
4. Do we love ourselves for the sake of the well being of the community or for the sake of ourselves?

Ownership of responsibility and giving oneself permission to be responsible are highlighted in two events of our religious life: confession of sins and confirming our faith (affirmation of baptism).

In confession we acknowledge our sin, and we own it. We ask God for a renewal of ourselves so that we can find ourselves doing that which is right. Note Psalm 51.

In the Affirmation of Baptism we are asked to respond positively to this question:

> You have made public profession of your faith. Do you intend to continue in the covenant God made with you in Holy Baptism:
>
> to live among God's faithful people,
> to hear his Word and share in his supper,
> to proclaim the good news of God in Christ through word and deed,
> to serve all people, following the example of our Lord Jesus, and to strive for justice and peace in all the earth?

Maybe we should substitute the phrase "give yourself permission" for the word "intend?"

One final note. In the book of Proverbs wisdom is discussed as a way of life. In chapters 7 and 8 wisdom, a female, is compared with another woman, an adulteress. The distinction between the two is that the adulteress seduces, appealing to our prurient interest, and wisdom calls for obedience. In both cases one can give oneself permission to act. In one case, the action is in response to seduction, and in the other the action is done on one's own authority.

Conclusion

The human body is an ecosystem created by God. There is every reason to treat all ecosystems, like ponds and human bodies, with the same dignity and respect we treat the whole of God's handiwork.

Both ponds and the human body age, but the time frame is different. Ponds can live longer. Ponds can outgrow various disruptions, and there

is time for adaptation to occur. The human body outgrows some of its ailments, too. But it also begins to fall apart as it gets older. How shall we look at time? Both ponds and the human body require care.

Another distinction between a pond and the human body is that a pond cannot be anything other than an ecosystem. For the human, one can become an egosystem.

As an ecosystem the human body is very complex. Like any ecosystem the greater the diversity the more successful it will function. Knowledge of details of the human body may not necessarily affect our attitudes. However, the marvel of it all may give us pause when we decide to endanger its complexity.

The human body is the dwelling place of God, the temple of the Holy Spirit, according to Paul, and the place where Christ resides. The body is a vessel that God uses to encounter others. This should also have some implications for our behavior.

I AM A POND

Sit beside me
and reflect

Walk beside me
and listen

Breathe deeply,
inhale my scents

Reach out and touch me,
I am warm

Care for me,
I am vulnerable

Abuse me not,
I am filled with life

Celebrate me,
I am God's creation!