CREATOR
VOLUME 28 NUMBER 1

Heart to Heart

"I will give them a heart to know Me, that I am the Lord." Jeremiah 24:7

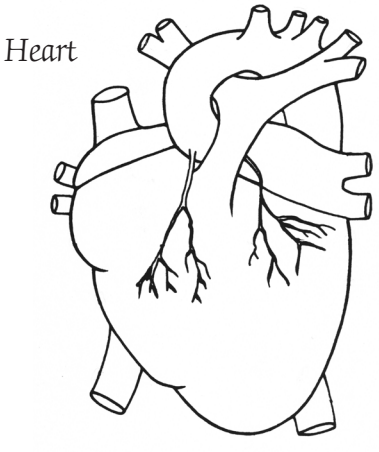
Boy, it's really cold out there, and the lights are incredibly bright! To top it off, Jenny's asleep. I don't mean to complain, but I feel so alone. *May I talk with you?*

Please allow me to properly introduce myself . . . I'm Jenny's heart.[1] The Lord Jesus skillfully knit me together in her mother's womb (Psalm 139:13), and I've been with her practically all her life. I began beating when she was only three weeks old. My God-ordained mission is to pump blood throughout her body, supplying it with vital oxygen, nutrients, vitamins, hormones, and protective antibodies. Like countless "bubbling brooks" fed by spring rains, Jenny's blood vessels form an amazing network of "streams" that bring life to her cells, while cleaning up after them. (They're so messy!)

Even when she rests, I rarely miss a beat. You see, *I don't sleep* but continue to pump blood every second of her life. I wonder how many folks stop to consider God's utter faithfulness in maintaining their hearts. Our Creator's engineering of blood flow in Jenny's body (and yours too) is nothing short of miraculous! It reveals His loving care for each and every human being. Now if you have a few minutes, I'd like to share with you the genius of His incredible circulatory design.

Doctors use the words *circulation* and *circulatory* to describe the flow of blood throughout your body because your blood *circulates* within you. The circulatory system is incredibly complex and surely reflects the wisdom and skill of its Maker. But basically, it has just two parts: pumps and pipes.

Christ Jesus laid out an enormous network of living tubes[2] within your body, which stretches 60,000 miles (96,500 kilometers).[3] This ensures that life-giving blood reaches all 70 trillion cells (that's a lot of cells). Some of these pipes are huge, like the *aorta* (pronounced ay - OR - tah). It is an elastic tube attached to your heart that directs blood to all those hungry little cells.

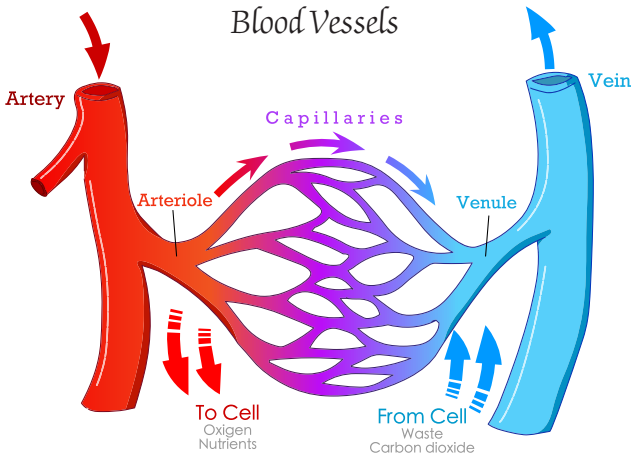


1 Jenny is a fictitious 8-year-old girl.

2 Blood vessels are composed of millions of living cells.
3 Equivalent to two-and-one-half times around the equator

Your circulatory system includes three different tubes or vessels: *arteries*, *veins*, and *capillaries*. An artery carries blood—which is under a great deal of pressure—*away from your heart*. Arteries, therefore, have been specially designed by Creator Jesus to handle this pressure. He reinforces them with microscopic muscles and extra-stretchy, elastic material. Veins are relatively thin ducts with less-muscular walls that bring blood *back to your heart*.[4] Capillaries are extremely tiny and delicate vessels that come in direct contact with the cells and tissues of your body. They are generally too small for the naked eye to see, yet most of the plumbing inside your body consists of capillaries.

Capillaries are extremely important because they form the frontline means of delivering "goods" to your cells and removing waste. Think of your circulatory system as the roadways in a major city: Highways and expressways (arteries) quickly bring supplies into the city from outlying warehouses;[5] other routes allow cars and trucks to safely leave (veins). The real commerce, however, takes place on the small side streets (capillaries) where couriers slow down their vehicles to make deliveries (oxygen and nutrients), and trash trucks pick up unwanted materials (carbon dioxide and other cell waste products). And like a busy city, the "flow of traffic on the roadways" of your body never ceases day or night.



The other component of blood flow, and the thing that makes the "traffic" of your blood move, is a marvelous muscular pump called the *heart*. Hold your hand in front of your chest and make a fist—this is the approximate size of your heart. Located just behind your breastbone (sternum) and left of center, it weighs less than a pound (in an adult, 10 to 12 ounces or one-third of a kilogram). But don't let its size fool you because the heart clearly proclaims the strength of an Almighty God!

Why is my design so remarkable? Well, if you've ever done pushups or some other repetitive exercise, you know that it doesn't take long before you become tired. If you continue to work the various muscles of your arms, legs, back, neck, and ears, you will eventually need to stop. (Can you wiggle your ears? Muscles connected to your ears allow them to move back and forth. But wiggle your ears for more than a minute and they will get sore.) Most muscles *must rest several minutes* after even short bouts of intense activity. Christ purposely designed them this way. It points to how sweetly dependent we are upon Him, for *He alone is our Strength and true Rest* (Isaiah 41:10; Matthew 11:28-30)!

The muscles of your heart are quite different. Collectively called the *myocardium* (my - oh - KAR - dee - uhm), they never cease working. I keep beating in Jenny's chest, 80 to 100 times each minute, day and night, night and day. On average, a person's heart beats 100,000 times a day and up to three billion times during their lifetime. We stop and rest for no more than a second between contractions, yet *don't tire out*. No other muscle in the body can do this. Isn't our Creator wonderful?!

4 The blood pressure in veins is a fraction of what it is in arteries.
5 The "warehouses" of your body include the lungs, digestive tract, liver, and various glands.

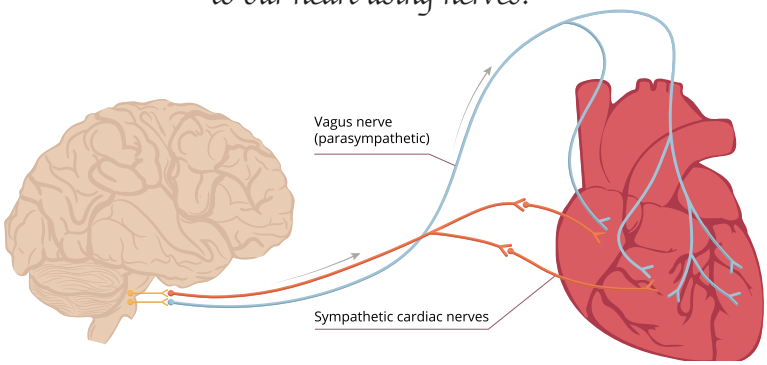
Every minute, I pump the equivalent of Jenny's entire blood volume through my chambers (more than two quarts/liters). In an adult, this equals eleven pints (five liters) per minute, or 2,000 gallons (7,500 liters) of blood each day. The great strength that Christ Jesus gave me is not the same as the brute force of an earthquake or tornado though. Natural disasters properly demonstrate the terrible power of God; the human heart reveals His power in a more subtle way.

Each time I beat, I push approximately two ounces (60 ml) of blood into Jenny's arteries. This may not seem like much, but over Jenny's lifetime, it will amount to many millions of gallons. Unlike the spasmodic fury of a volcano, the Lord uses me to demonstrate *His enduring strength* and *His persevering love*. Let me put it another way. I can push only a small quantity of blood through Jenny's blood vessels with each contraction, yet the sum total of all my beats in a 24-hour period is powerful enough to lift a compact car twenty-five feet (eight meters) off the ground!

The heart rate of an adult averages 70-75 per minute, though a woman's pulse tends to be slightly higher than a man's. The heart of a baby inside his or her mother's womb beats twice as fast, or about 150 per minute. An older child like Jenny has a heart rate between 80-100 at rest. When Jenny exercises, her heart pumps more vigorously to supply additional oxygen to her muscles; when she sleeps, it decreases. Her pulse also speeds up when she runs a fever.

The pumping of the heart is *regulated* by your brain, as well as hormones released into the bloodstream. Your heart can, however, beat on its own. There is a special group of cells Creator Jesus placed on the right side of the heart that acts like a tiny rhythmic generator of electricity.[6] The electrical impulse created here travels through the heart like electricity moving along wires

Our Lord Jesus connects our brain to our heart using nerves.



inside the walls of a building. It is the surge of this electrical impulse, occurring every second or so, that causes the muscles in the heart to contract and pump blood. A doctor can measure this electrical activity using a machine called an electrocardiograph.[7]

I haven't mentioned this yet—and by the way, thanks for being such a good listener . . . I feel less lonely now—Jenny's heart is actually four-pumps-in-one. I'm composed of two atria (single–atrium) and two ventricles (see picture on page 4). The atria are thin-walled chambers in the upper part of the heart that receive blood from the body and help move it into the two muscular pumps below, her ventricles. The right atrium delivers blood to the right ventricle and the left atrium delivers blood to the left ventricle. In turn, the right ventricle pumps oxygen-poor blood into the capillaries of her lungs where the blood becomes bright red with oxygen.

In her lungs, God causes blood to release carbon dioxide,[8] because increased levels of carbon dioxide are poisonous to Jenny's body. Jesus also causes oxygen to be picked up here. Oxygen-rich blood returns to her heart via the left atrium and is pumped into the left ventricle. The powerful left ventricle then forces blood out through her aorta, the largest artery in her body, and into the many blood vessels that compose her circulatory system.

6 Known as the sinus or sinoatrial (SA) node

7 The heart produces the greatest electromagnetic field in the body.
8 Carbon dioxide is a waste product of normal cell metabolism.

Each time Jenny's left ventricle pushes blood into her arteries, it creates blood pressure (BP). This is akin to the pressure necessary to force water through a pipe, though it's much more sophisticated. Without the constant pressure exerted by my four pumps/chambers, Jenny's blood would cease to flow through her arteries and veins, and she would die. In most people, the Lord Jesus Christ carefully maintains a BP between 80 and 120 millimeters of mercury.[9] A nurse or a doctor can measure your BP using a simple instrument with a difficult name, a sphygmomanometer (SFIG - mow - mah - NOM - ih - ter), or blood pressure cuff.[10]

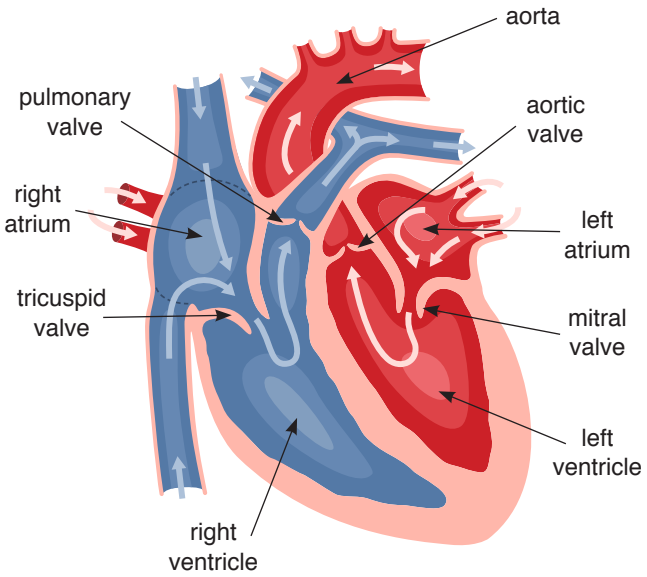
In the doctor's office, blood pressure is expressed as a ratio of two numbers; the BP mentioned above would be written 120/80. These numbers represent the pressure necessary to keep blood moving within the body. Along with the pumping action of the heart, elastic arteries are crucial for maintaining a normal BP. As I push blood into Jenny's bloodstream, her arteries stretch to prevent her BP from going too high and then contract to keep her BP from falling too low as I briefly relax my muscles. It's critical that her BP be maintained at just the right levels. Chronically high BP, known as *hypertension*, can damage the arteries over time, and a low BP (*hypotension*) will prevent the organs (brain, kidneys, etc.) of the body from getting enough oxygen to function properly.

It's also important that blood flows through my atria and ventricles in the correct direction. The Lord Jesus, therefore, placed four different one-way valves inside me. There is a valve between each atrium and ventricle (the tricuspid and mitral valves), and between each ventricle and its corresponding artery (the pulmonary and aortic valves).

How do we know all this? Well, the study of the heart and circulatory system began in earnest during the 17th century. A man named William Harvey, the court physician for King Charles I of England, became the first person to understand the basic workings of the heart and blood vessels. In 1628, Dr. Harvey published an important paper describing the flow of blood throughout the body.[11] What an exciting time that must have been to be alive!

Fortunately for Jenny, Jesus has caused the wisdom and skill of physicians to steadily increase over the past 400 years. As a young child, she had an infection[12] that damaged her mitral valve, one of the four valves located within me. This eventually necessitated the open-heart surgery she has been undergoing for the past several hours.

The surgeons have just finished sewing me up and it appears that the operation was a success. I can't wait till she's awake again! We should never take anything for granted, but, God willing, I will go on demonstrating the faithful strength and loving care of Christ, serving Jenny for many years to come.



Blood flow in heart

9 This is the force or pressure necessary to raise a column of mercury 80 to 120 millimeters in a glass tube.
10 From Greek sphugmos, "pulse" + French manomètre, "pressure meter"

11 *De Motu Cordis*
12 Streptococcal infection causing rheumatic fever

Animal Beats

"Worthy are You, our Lord and our God, to receive glory and honor and power; for You created all things, and because of Your will they existed, and were created." Revelation 4:11

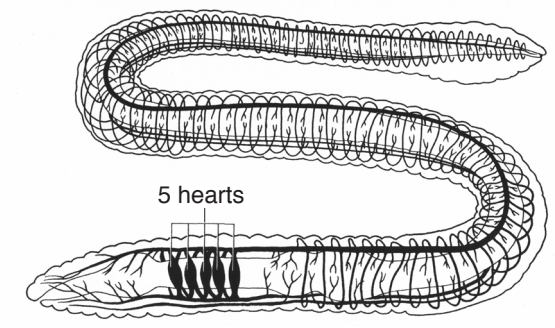
If, by some means, we could hear the heartbeats of all animals and all people in the world at the same time, what a sound that would be! The fury of an exploding volcano might seem dull in comparison. Fortunately for our ears, most hearts are buried deep within the bodies of the living things they inhabit and we normally don't hear them beating. In this way, Jesus brings His all-powerful life to each of His creatures, *quietly . . . humbly*.

I am constantly amazed at the incredible variety of Christ's creations! Some hearts are simple tubes that pulsate, while others are a complex of two-, three-, or four-chambered pumps. Would you believe me if I told you that many animals have more than one heart and some have none? The tiny mite is one


Mite

such enigma—it has no heart.[13] (We "mite" say it's heartless!)

The earthworm, on the other hand, owns five hearts. It also has a *closed circulatory system*, which means that its blood is always contained within arteries,

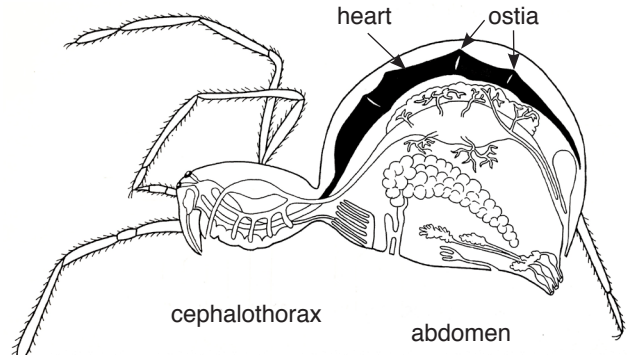


Earthworm—closed circulatory system

capillaries, and veins, much like our own bloodstream. (Maybe our Lord designed a worm's circulatory system to be like ours to remind us that we come from the very dust of the earth that the earthworm inhabits—Ecclesiastes 3:18-20.) Most invertebrates, like the scorpion and spider, have an *open circulatory system*. Their blood is pumped from the heart directly into the tissues, bathing them. In the open circulatory system, blood is not found in blood vessels—these animals have no capillaries or veins.

An earthworm's blood is red because it contains hemoglobin (hee - mo - GLO - ben). Hemoglobin carries oxygen to cells and is the same substance found in our blood. Since an earthworm has no lungs, hemoglobin picks up oxygen from the outside air when its blood passes through the worm's thin skin.

Christ placed a spider's heart in its abdomen, not in its chest (cephalothorax). And the blood of a spider is pale blue, not

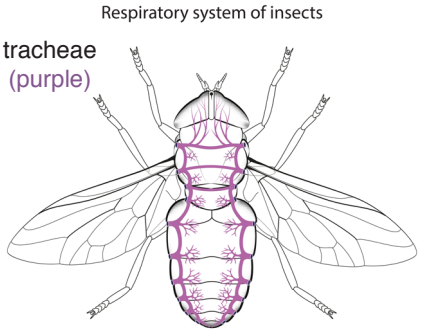


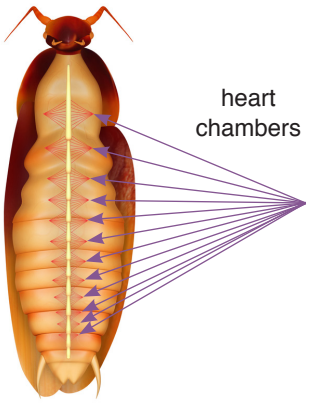
Spider—open circulatory system

13 It circulates blood by contracting body muscles. Jellyfish, coral, starfish, and flatworms are other creaures that lack a heart.

red, because it possesses a copper-containing chemical called *hemocyanin* (hee - mo - SY - an - in).[14] Blood squeezes around its organs and squishes through its tissues (remember it has no blood vessels) and returns to the heart by way of holes called ostia (OS - tee - ah). Ostia line the sides of a spider's heart and have one-way valves to ensure that blood flows in only one direction. Surprisingly, the blood pressure of a spider at rest matches our own. Its pressure doubles when active, however, something that would land us in the hospital! Blood pressure is important in all God's creatures. It's what allows a spider to extend its legs and a butterfly to unroll its straw-like tongue.

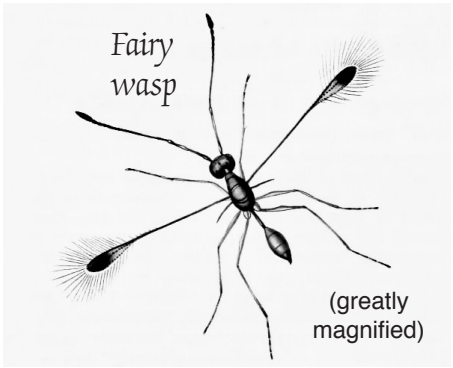
Speaking of insects, the blood of a grasshopper appears colorless or green—our Creator did not design it to carry oxygen to the tissues.[15] Instead, Christ created tubes within the insect called tracheae (TREY-kee-ee) that transport oxygen from the outside world directly to its organs.





Cutaway of a cockroach's 12-chambered heart

One of the strangest hearts in the animal kingdom belongs to the common cockroach. Having 12 or 13 chambers (compared to our four), it beats at the same rate as our heart (pulse around 85).



The animal with the smallest heart is the fairy wasp. A microscope is needed to see it. This organism is also the world's smallest insect and smallest known flying creature.

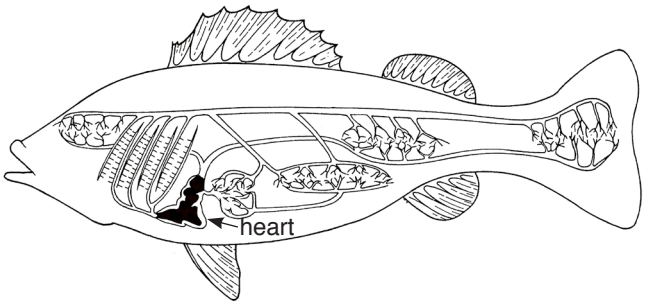
By far, the largest heart relative to animal size belongs to the scorpion. In some scorpions, the heart takes up one-third of the body cavity. Like all arthropods (spiders, scorpions, insects, lobsters, crayfish), the scorpion has an open circulatory system. And its blood is light blue in color, due to hemocyanin.

Cephalopods (squid, octopus, cuttlefish, and nautilus) are also blue-blooded but possess a closed circulatory system.[16] God gifted these unique marine creatures with three hearts: two branchial hearts that pump

The octopus has three hearts.

blood through the gills (where oxygen is picked up) and one central heart that moves oxygenated blood into the rest of the body.

14 Hemoglobin contains iron.
15 It has no hemoglobin or hemocyanin.
16 Why God made some invertebrates (worms, squid) with a closed circulation and others open (spiders) is a mystery. He is Sovereign over all Creation!



Fish—closed circulatory system

If we shift from discussing invertebrates to vertebrates (fish, frogs, reptiles, birds, and mammals), we find that God supplies all vertebrates with a closed circulatory system, a single heart,[17] and many blood vessels. The heart of a fish consists of one atrium and one ventricle. Its atrium is a thin-walled pump that receives blood from the fish's organs and moves it into the muscular ventricle. The ventricle then pumps oxygen-poor blood through the gills where it picks up oxygen. From there, the blood circulates throughout the fish's body again.

The heart of an amphibian (frog, salamander) consists of two atria and one ventricle; by contrast, Christ created the heart of birds, mammals, and people with two atria and two ventricles. Most reptiles have a three-chambered heart, but crocodilians own four.

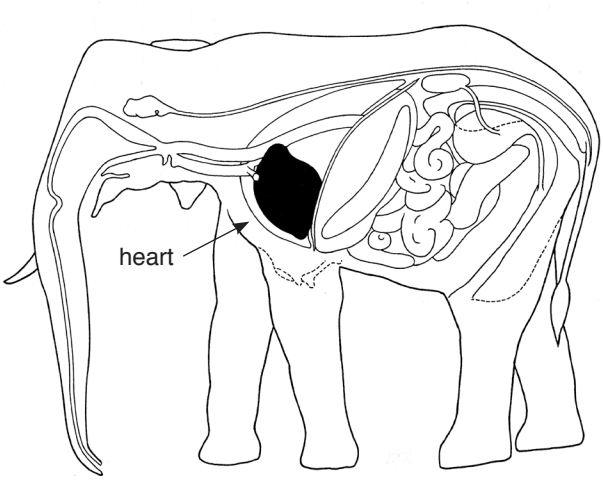
17 Possessing 2, 3, or 4 chambers

A quick survey of the animal kingdom reveals that mammals enjoy the largest of hearts. An elephant's is huge by human standards, up to 60 pounds (27 kg). By far, the grand-daddy of all pumps is the massive heart of the blue whale, the largest creature God ever made. Its heart weighs 1,000 pounds (450 kilograms), the size of a dairy cow! A powerful surge of blood—58 gallons (265 liters)—is produced each time it beats.

If we compare the *size* of a creature's heart to its *heart rate* (the number of times it beats in one minute) we find an intriguing relationship. The larger the animal, the slower the heart pumps. Conversely, the smaller the animal, the faster its heart beats.

Many critters possess a heart that works much faster than ours: A cat's pulse averages about 150 times per minute. The pulse of a mouse races at 650, and that of an Etruscan

The hagfish teaches us that our Creator's ways are unpredictable and truly unfathomable (Romans 11:33). The Lord Jesus gave it four hearts—all other bony creatures have one. And this fish has the lowest BP of all vertebrates. A normal systolic pressure in humans is 120 but in the hagfish it ranges from 6 to 10.

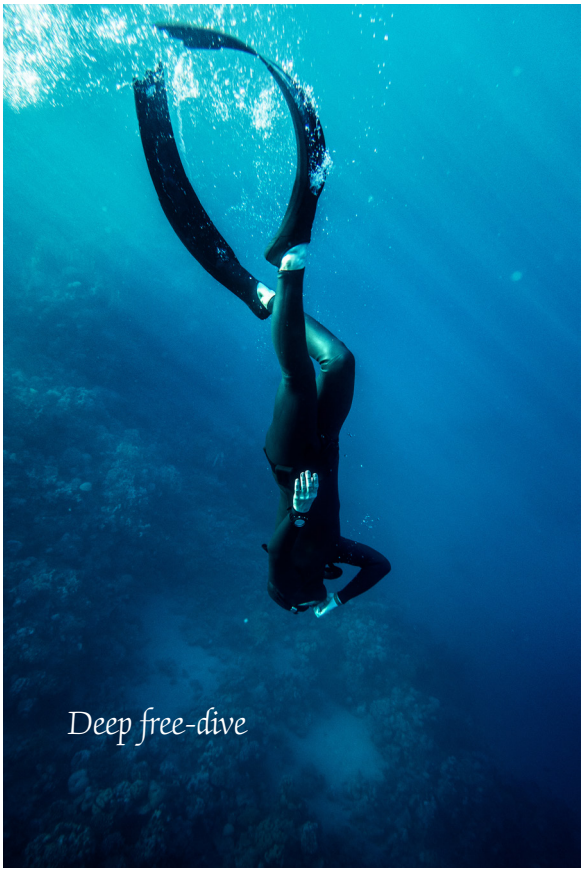


Elephant—anatomy

shrew, the world's smallest mammal, an incredible 1,200 beats in just one minute! At the other end of the spectrum, a horse's heart beats approximately 40 times each minute, and an elephant's, just 30. And the heart rate of a diving blue whale may go as low as four beats a minute at extreme ocean depths.

Other creatures undergo the same phenomenon when diving underwater. In the case of a beaver, its heart rate decreases from a normal 140 beats per minute to 10 while diving deep into a pond. The same is true of penguins—their heart rate goes from 120 to 6 as they swim underwater. It has been

documented that even people experience a change in heart activity during skin diving. An otherwise normal human being will encounter a decrease in pulse from 70 to 35 while submerged. It is not known exactly why Jesus created the heart to react this way, but some scientists feel it has something to do with the shunting of blood to vital organs and



Deep free-dive

preservation of oxygen. One also wonders if the envelope of water might have a calming effect, like an unborn baby in the womb of his mother.

The hearts of many animals also slow down during hibernation. A golden hamster normally has a pulse of 350. While hibernating, it drops to as low as four or five beats a minute.

The incredible variety and function of the hearts God has fashioned are almost unbelievable. Christ certainly reveals the sweet care of His Father, and His own awesome power and strength!

A Heart of Grace

Blessed is a man who perseveres under trial; for once he has been approved, he will receive the crown of life which the Lord has promised to those who love Him.
James 1:12

Do you have a good heart? There are at least two ways of looking at this question: 1) Is your heart physically sound? 2) Are you good-hearted? (Are you basically a "good" person?) So what I'm really asking is, "Are you a good person?" If you are, what determines your goodness? Going to church? Giving to charities? Showing "tolerance" for those different from you? Not swearing or cussing? The Bible explains, however, that these things don't determine goodness. Then what does?

"No one is good except God alone," Jesus told the rich young man (Luke 18:19). In effect, Jesus was saying, "No one can be good if they are not from God." How, then, can we determine if we are from God? There's only one way: Are we united to God through Jesus Christ?

Spiritually speaking, apart from Christ we are very sick people. "The heart is more deceitful than all else and is desperately sick" (Jeremiah 17:9). Because of sin, our "heart" or soul is diseased and dying. Without Christ, we are dead in our sins (Ephesians 2:1, 5).

The Lord is angry with the wicked every day (Psalm 7:11 KJV). "Do you not know that the unrighteous will not inherit the kingdom of God? Do not be deceived; neither fornicators, nor idolaters, nor adulterers, nor effeminate, nor homosexuals, nor thieves, nor the covetous, nor drunkards, nor revilers, nor swindlers, will inherit the kingdom of God" (1 Corinthians 6:9-10). Everyone who refuses to repent and become united to Christ is destined to experience an unspeakably painful, eternal death in Hell. Certainly not a pleasant thought. *But there is good news!* God is the Great Physician and He can transplant a good heart into us, removing our "heart of stone" while giving us "a heart of flesh" (Ezekiel 36:26)—one that will love and obey Him. This good heart comes from God Himself (1 John 4:15), and we share it with Him.

Christ died on the Cross, taking on Himself the punishment for the sins of His people (1 Peter 3:18). Are you ready to believe this and turn from your sins? It's one thing to believe a doctor can cure you. It's quite another to put your very life into his hands and allow him to perform surgery on you. Are you willing to "go under the knife" and receive a heart transplant? If you are, this is His grace.

Grace is the operation of the Spirit that replaces an infected and corrupt heart *with the heart of a King*. It is God's grace that leads us to repent and truly believe that Jesus died for us. (He had to die. After all, whoever heard of removing the heart of a man still walking around?) Christ's righteous heart can be transplanted into our life if we humbly receive it. *We share it with Him*. We certainly don't deserve Christ's righteous life—there's nothing we've done, or can do, to earn it—this is grace!

What effect, then, does grace have on our lives if we are willing to receive it from God? We can't see the heart of a man beating within him, yet we do not fail to perceive its impact on his life. A transplanted heart will bring an ill person back to life.[18] Divine grace produces *eternal life* in us, and a desire to know God. We will then long for His Word (the Bible) like a newborn baby who craves milk (1 Peter 2:2). Christ's Spirit will also grow our faith and our desire to obey Him.

Such is the grace of Christ's love. It is a free gift, but not an ineffective gift! Once grace has been implanted into the life of a person, it continues to beat *for all eternity* by "the power of an indestructible life" (Hebrews 7:16).

18 That is, one who has serious heart disease.

The enduring strength of the Lord Jesus Christ cannot help but have its effect on all those who are saved from Hell. As blood steadily courses through the veins of our body, grace penetrates every fiber of our being and it will bear fruit as good works (Ephesians 2:10, Titus 2:11-13). Grace cannot be dead because it is the gift of *the living God*. Christ rose from the grave because He has power over death. *He is Life* (1 John 1:2)!

If we don't receive the new heart we so desperately need, neither will we receive the gift of faith nor God's beautiful and precious Son. As Jesus said to Nicodemus, "unless one is born of water and the Spirit he cannot enter into the kingdom of God" (John 3:5). We are all born physical beings (we are composed of water)[19] and we have a physical heart. But we also must be born of Christ's Spirit and receive a spiritual heart (be converted). If we humbly confess our sins and believe that only Christ's blood can and will wash away that sin, then His Spirit will assure our hearts that we are His (Romans 8:16). This is grace!

Are you ready to undergo the Surgeon's knife and humbly cry out with the Psalmist, "Create in me a clean heart, O God" (Psalm 51:10)? Or will pride and fear keep you away? (Jenny was afraid but trusted her doctors.) Trust in Christ, "the Lamb of God who takes away the sin of the world!" (John 1:29).

19 Christ fashioned our bodies using 70% water.

If you commit yourself to Him in obedience and receive His righteousness and heart of grace, you will be saved from God's terrible wrath against your sins.

If you confess with your mouth Jesus as Lord, and believe in your heart that God raised Him from the dead, you will be saved; for with the heart a person believes, resulting in righteousness.
Romans 10:9-10a

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