Your Spark is Light

The Quantum Mechanics of Human Creation

By Courtney Hunt, MD

With the help of Kara Dunn

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To my husband, Sammy

On our first date you promised me two things: to make me happier than I have ever been and to know God. You have given me both of them. Thank you for being my protector, my guide, my best friend. I love you with all of my heart and soul, across space and time.

To my children, John William and Sophia

It is from your light that mine shines. I set out to make a path for the two of you to be able to find me, always and forever. I went looking for light. I asked for God to illuminate me. I asked for you and for me. Take this light and shine it bright my loves. Use it to bring good to the world. Always and forever.

Kara

In the summer of 2018, a young woman named Kara Dunn set off on her break from college to travel across Europe. She was so excited to spend her summer there. Her first stop was Seville, Spain. When she landed, she immediately began having trouble with her vision and speech. I still remember the June morning when her mother called me in a panic, knowing, as mothers do, that something was seriously wrong with her daughter, thousands of miles away. She was traveling with just one other young woman. Kara had worked for me for several years, and we were connected. Bonded. Even before the trip. Perhaps we both already knew what was to come. What ensued over the next 48 hours was terrifying. Kara developed Guillain Barré syndrome, a rapidly debilitating neurological condition in which the person becomes locked in. Trapped. Unable to move or breathe. She deteriorated over forty-eight hours and was intubated in a Spanish ICU, alone, except for one friend. During that time, Kara went to the edge. She saw the light. And she came back. After almost two weeks she was evacuated to the United States, where it took her over a year to be able to walk and recover. The night she landed I wept at the sight of her weak body in her hospital bed. I was so glad she had made it home to us. We worked on her recovery for months, and last fall she decided school was too much and to take a break from college and come back to work with me. When she did, she decided to tell me of her encounter in Seville. I was amazed at her courage. In that ICU, you see, in the most vulnerable state any person could ever be in, she endured the evil that one human can impose on another. But she

also saw the light. She went there and she came back. And I now know why. That day, I told her of the book I was writing and the details of my life in preparing for the book.

It all made sense. That day, Kara dedicated herself to healing and to writing this with me. She gave countless hours of her time, helping me all day, all night, by my side, every day for months. She never said no. She never gave up. She never took a break. Her wisdom she gained from her near-death experience was beyond her years, and it was invaluable in the creation of this book. I love you, Kara. Because of you, we got it done.

A special thank you to Dawn Dunn-Rice for sharing your beautiful daughter with me, and for making us the most beautiful book cover artwork a mother could ask for.

Thank you to Amy Lamotte for editing our book, and for being my friend in the light, mitochondria, and DNA.

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Preface

In labor and delivery units across America, there is a doorbell of sorts that is rung multiple times per day. In the hospital where I spent years delivering babies it looked like a light switch outlined by the figure of a stork, like the memories I have of the animal cover that hung over the switch on the wall in my childhood bedroom. When a baby is born, the new parents get to push the button as they make their way to their postpartum room. It sends a lullaby through the halls of the hospital, announcing to the rest of the patients and their families-- young and old, sick and not-so-sick-- that a new life has been brought into the world. The nursery chime resonates through every hall in the hospital, from the intensive care unit to the emergency department. This is the chime that rings with each new life.

It is a comforting feeling for me, even now. My name is Courtney Hunt. I am an obstetrician-gynecologist. I stopped delivering babies five years ago. To this day, whenever I visit friends or aging patients in the main hospital, with its sterile scent and bright lights, the bell chimes and my heart swells with the awareness that excited parents have stopped to push the button and announce the gift of their new baby. I still tear up when I hear it. Some of my sickest patients and their families have told me that the music shines like a light on some of their darkest hours.

What if this was the sound of every miracle baby? What if every member of humanity would one day be able to "hear" the arrival of each new soul into this universe-- to "hear" the magnificent bodies of light that we are as we arrive in our mother's abdomen? What would that do for humanity?

What if every woman knew her power to call a quantum code that is consciousness into this world to be bound to the tiny baby inside of her? What if she knew her power to bring the light into a vessel that we call a body?

That day is here.

I have delivered thousands of babies into this world. I have watched children grow. For the most part, I have seen them flourish. I have also seen them suffer with illness and pain. I have lost a few. Those lost babies and children hold special places in my heart, and this book is in part for them. There is one in particular who's memory helped me to write this. For me, he planted the seed for a million dreams that kept me awake. There are children in this world who are suffering today, the forgotten ones, the sick ones. This book is for humanity, for women, and for those children in particular. Women are the light bringers. It is in the woman and only the woman that the power to call the quantum code that is the baby's consciousness exists. On these pages I will share the science of fertilization and delivery, but not the delivery you would think of. The delivery I am referring to is the delivery of the soul into the body.

In 2010, after delivering other people's babies for 13 years, I had the first of my own. My beautiful John William. Moments after he was born the doctor handed him to me, and my first words were, *this is the best thing that has ever happened to me.* A few mornings after we arrived home, I put him in his stroller and took him for a walk early on a sweltering Arizona morning. I vividly recall turning a corner to face the sunrise with him and thinking, *God has just handed me my heart. It has been pulled from my chest and placed in my arms for me to care for.* When my daughter Sophia was born, my husband and son were both sick

with the flu. The first few days it was just the two of us at the hospital. I had four days with her tiny body naked on my chest. For any mother who has breast fed, you know that feeling. There is no end to where their tiny body ends and yours begins. You are in tune to their every breath, every sigh, every cry, intimately connected with their being. With the birth of each of my two children I thought, how amazing is God? How can anyone who has had a child not recognize the magnificent design of this human body? The ability of a woman's body to take the DNA of an egg and sperm and in 40 weeks' time grow a complete human being from just two cells amazes me, even as an obstetrician 20 years into her practice. Even though that was my chosen career, the personal experience of growing a baby inside of me 10 years into my career made it a more profound and awe-inspiring event. A single cell that multiplies in a series of divisions through a storm of massive growth and potential, developing fast and furious based on a genetic code handed down through the ages. That code carries the epigenetic memories of our ancestors. After just 40 weeks of development, that code allows us to deliver a fully formed human being. How could that be so perfectly orchestrated, if not for divine design? And then that child is born into a family somewhere on earth. With that spark of life, when the sperm meets the egg, an entire universe is born. There are more nerve synapses in that tiny little head than stars in our galaxy. With those nerves in that brain comes the promise of infinite potential, limited only by the social confinement we place on him or her.

For many of you, you are awaiting a book from me that details how to bring your body into a state of health, or what I call flow--when you connect with the universe to feel the light of which I often speak. The light that makes every atom in your body feel like it wants to stand up and sing a universal symphony. And that

book is coming later. Below, I'll summarize how to bring yourself into a state that will raise your cognition so you may understand what I'm about to discuss. This advice will be brief, for the contents of this book take precedence. Mothers across the world need to know their power. Women need to know that they, and only they, carry the machinery necessary to call the soul from another dimension in the world of physics. Some call quantum physics magic. Even Einstein called quantum entanglement "spooky action at a distance". And so, here is the scientific story of how the soul or consciousness enters the baby. Here is the scientific explanation of Adam and Eve.

Chapter 1: Introduction

At some time in every human life we ask ourselves, "where do we come from and where do we go?" Why would you care? Eventually, everyone cares. Eventually, every single one of us will ask ourselves this question. It may be when you fall victim to a trauma or an illness. It may be when you have your first child. That's when it hit me. It may be when you lose a loved one. And it may not be until the end, when your time here is almost up. But one day, we all ask. On these pages the answers will reveal themselves. What is it that fires up your body, allowing you to grow from a single cell into a fetus, baby, child, adult and exist on this earth for 80 years or so and then burn out when it is time to go. At the moment of conception there is a halo that can now be seen in the lab when the egg meets the sperm. At that moment scientists know that the single celled zygote is viable, meaning it will grow into a baby. They use it to choose the strongest one in the petri dish for transfer back into the mother during in vitro fertilization. That halo that has been identified, that spark that is seen is the moment the soul enters the zygote. I will show you how it acts as an antenna trapping your energy or consciousness here in your body, and how the identification of it provides the union between religion and science. Science has now identified all of the pieces of how a human is created or how our consciousness is called from the energy field or Higgs field that surrounds us. We have identified the parts of how the soul comes from the light. This story is the grand unification of religion and science at the top of their fields. It is the quantum mechanics of fertilization. On these pages you will see how at the moment of the merger of our parents' sperm and egg the zinc spark released tells the world our soul has arrived. This knowledge will show all of humanity that we come from the same light. It will unite us all. It is for all people. No man, woman, or child to be left out.

In order to understand what I am about to share, it may be necessary to bring yourself into optimal health the way nature intended, using diet and light. Throughout this book you will see how our bodies are designed to be connected to sunlight. The quantum physics of that interaction will be explained in detail. We are entering a period of reawakening to the power of the sun to heal us. Circadian biology is one of the most rapidly progressing fields in medicine. Institutions like Harvard have centers for photobiomodulation to use the power of light to heal. If you are not feeling well or are suffering from a foggy brain, anxiety, depression, attention problems, etc., let's bring you to a state of improved function so that you can understand the science of this book. Let us begin with some simple instructions on how to help your brain function optimally if you want to better understand the following chapters. The book has been written to explain the science while also giving simple analogies so that everyone may understand. Intensely scientific portions are included to explain the details of the biology and physics, but they will be followed by paragraphs labelled "Simply Stated" and presented as analogy for ease of understanding. As Einstein said, "If you can't explain it to a six-year-old, you don't understand it yourself."

On these pages I will show you how you are energy beings that utilize adenosine triphosphate (ATP), the energy or information molecule made by your mitochondria or batteries inside your cells. You are an antenna for light. No matter how sick, tired, or foggy headed you are, this path will lead you to the cognition you need to understand these concepts. Follow these steps and you will learn to see, bringing yourself to the level of connection, or what I call flow, needed so that the information you will read in the upcoming chapters will be easily digestible.

For those of you with a science background or who are already in good health, you are free to move ahead.

For those who need healing, start here:

You will need to begin by being present in the sunrise every single morning. Rise up and face east. Go outside without glasses or contacts covering your eyes. Try to be grounded-- barefoot on grass, dirt, or cement. Whenever possible, watch the sunrise with limited clothing on. Receiving the light from the sun in the morning will allow you to load yourself with the waves of light necessary to start all of the biological processes you need for the day.[1]

Once the sun has come over the horizon, you may look just a few degrees off. Take care that you are well-hydrated, so you don't burn your eyes.

Spending time at sunrise will allow your body to start creating the beneficial hormones it needs to start your day, and it will set the clock in your brain that regulates your mitochondria.[2] Spend as much time as you can-- even a few minutes is better than nothing. Whenever possible, stay longer. If you have the ability to stay for an hour, do it.

Begin to bring yourself into a state of ketosis. Religions have used ketosis and fasting for centuries to heal the body. Muslims practice fasting during Ramadan as do Christians during Lent.

Increase the fat in your diet and strive for a 3:1 or 4:1 fat to protein ratio. Start by limiting your carbohydrates to 50 grams. This is NOT a high protein diet. As you increase your sunrise time, slowly drop your total carbohydrates to 20 grams. Once you

do this, begin testing your urine for ketones using dipsticks. It is important that you move into a state of ketosis as you read this book because it will allow you to feel the power of the light or the electromagnetic field of which I am speaking. Make sure to include seafood in your diet daily to increase consumption of the omega-3 fatty acid DHA. Intake through food is always a better choice, but if you don't tolerate seafood, use a supplement. As will be explained in Chapter 7, DHA is the molecule that allows our brains to receive the signal from the light to spark our nervous systems.[3] It will improve your cognition so that the quantum physics that I discuss will be easier to understand. The mechanisms and benefits of ketosis will be further discussed also in Chapter 7.

After two weeks of watching the sunrise, you can start to expose yourself to midday sun. There is an app called DMinder that you can download onto your phone, which functions as a timer to show how long you can safely stay in the UV without burning. It takes into account your latitude, altitude, skin type, and cloud cover. If you always use this timer to receive sunshine and go inside or cover up when it says your time is up, you will not burn.

Your vitamin D level is a marker for all of the light you have received and says more about your state of health than almost any other lab you can have tested. Vitamin D is made in the skin by ultraviolet B (UVB) during midday sunlight. When UVB light is available, all of the other wavelengths of light are available, too. Therefore, vitamin D is a marker of all of the wavelengths of light you have received from midday sunshine. It should be noted that LDL cholesterol makes vitamin D in the skin, so the combination of ketosis (which will initially cause a release of cholesterol from your blood vessels) and sunlight exposure is forever bound and should be practiced together. It is important to realize that all of

the wavelengths of light are vital for optimal function of the human body.[4,5]

Proper sleep will be of utmost importance if you are to understand this book. To improve your sleep, you must fix your environment. Take steps to watch the sunset as much as possible, again with naked eyes. Keep your house dim after sunset so that your brain makes melatonin which will allow you to get the rest you need.

Now, the question is, how does that initial spark of light, the soul, come into this biological vessel?

Chapter 2: As Above, So Below

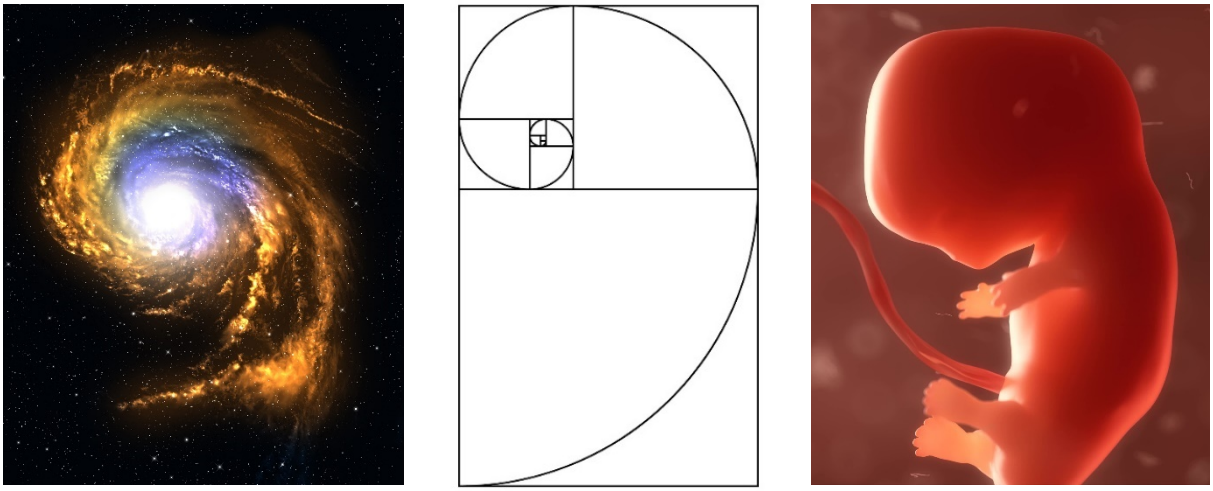
"When does the soul enter the body?" someone asked the Master.
"At the moment of conception," he replied. "When the sperm and ovum unite, there is a flash of light in the astral world. Souls there that are ready to be reborn, if their vibration matches that of the flash of light, rush to get in."
From Conversations with Yogananda

In nature, there is a pattern that repeats itself like an echo whispering information throughout the universe. The branches on a tree, the petals of a sunflower, the leaves of a cactus, the twist of DNA like the turn of a spiral staircase, all reveal this same repeating pattern. It is nature's way of self-organizing. If you look around, you will see that the pattern is everywhere, waiting to be observed, waiting to be noticed. This pattern is based on the Fibonacci sequence, a series of numbers: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34… the next number is found by adding the two preceding numbers. Some call it the magic equation to the universe. The ratio between these numbers is called the golden ratio or golden number, $=(\sqrt{5}-1)/2=1.618$. The golden ratio is present everywhere, from biology to astronomy. This implies that phenomena that occur on a microscopic or even quantum scale are modeled after those on a macroscopic scale and vice versa.

Like all parts of nature, it is imperative that human physiology optimizes space and most efficiently uses energy in order to maintain harmony. The golden ratio facilitates just that. While it has been established in the length of our fingers, facial symmetry, and even the proportions of the uterus, its presence in the heart is perhaps the most remarkable. Like the branching of a

tree, coronary arteries split off into smaller vessels to deliver blood to nourish all areas of the body. This branching and the specific location of coronary arteries have been found to follow calculations from phi.[6] Additionally, the ratio of diastolic to systolic blood pressure (with systole defined on an echocardiogram as the time between the R wave and the end of the T wave) is also equal to 1.618.[7] In a more visualizable example, the average hand-to-forearm ratio also follows phi.

Interestingly, the golden ratio is also utilized in embryometric analysis of blastocyst stage embryos. This is a process that fertility specialists may use to determine the most viable embryo for transfer back to the uterus-- the one with the most promise of successfully developing into a healthy baby. Five to six days after fertilization (in the blastocyst stage of embryonic development), a mass of cells called the inner cell mass (ICM) develops on one side of the primordial embryo, which will eventually grow into the fetus. Through embryometric analysis, it was identified that embryos with an ICM-to-total blastocyst area that most closely approaches phi are the most viable offspring. In other words, the ratio of the area of these cells to that of the total blastocyst is equal to 1.618.[8] This indicates the importance of the golden ratio in embryonic development.



The golden ratio can be seen from a nebula on the macroscale all the way down to an embryo on the microscale. The figure in the middle illustrates the golden ratio geometrically.

Keeping in mind the frequency of the golden ratio in nature, let us look at the tremendous scientific achievements of the past decade. In 2016, researchers at Northwestern University identified the zinc spark or halo that marks the successful merger of a sperm and egg, signifying that a new zygote has been formed. The zinc spark announces the initiation of embryonic development. In 2012, we saw the discovery of the Higgs boson at CERN (one of the leading centers for scientific research on the study of fundamental particles, located in Switzerland), proving the existence of the Higgs field-- the energy field that permeates every part of the universe. The Higgs boson is responsible for how energy acquires mass. Its existence proves that there is no such thing as empty space and that everything that surrounds us, every nook and cranny, is energy. 2015 marked the first audio recording of the "chirp" of two black holes merging in space,

obtained by LIGO (one of the world's largest gravitational wave observatories). This merging sounds just like a bird chirping or the "ring" Einstein predicted in his theory of general relativity. As stated by MIT, "A black hole, born from the cosmically quaking collisions of two massive black holes, should itself "ring" in the aftermath, producing gravitational waves much like a struck bell reverberates sound waves." Einstein predicted that the particular pitch and decay of these gravitational waves should be a direct signature of the newly formed black hole's mass and spin."[9] The sound heard is amazing. In 2019, the first photograph of a black hole, as also predicted by Einstein, was captured by researchers at MIT. These findings are each fantastic on their own, but collectively they reveal something magnificent. Though seemingly unrelated, this constellation of discoveries points to the *exact* moment that the soul or consciousness enters the body.

It is striking to see the image of the black hole next to that of the zinc spark. The similarity in appearance is uncanny, as if nature were modelling the fertilization of an egg after the event horizon of a black hole. As above, so below.

In order to understand these connections, we will show you the most up-to-date research in human egg fertilization and reproductive endocrinology. Next, we will explain how the human body is an antenna for light (the electromagnetic field), and how quantum phenomena are happening inside of us every day. This is the field of quantum biology, where physics and medicine meet. This field is newly emerging, and many argue that it holds the future of medicine.

Medicine is on the verge of a revolution that will greatly change the health of our society. Doctors are beginning to understand the power of the mitochondria and their central role in most

chronic diseases. The mitochondria are organelles (tiny functional structures) within the cell, and they use electrons from food to create a molecule called ATP. This ATP is essentially the body's currency of energy and information transfer. As such, medical professionals are shifting to focus on the health of mitochondria themselves.[10] In the past, the focus in biology was on the nucleus as commander of the cell. It was known to house the majority of the DNA, and was thought to regulate the inner workings of the cell by controlling DNA expression and which portions of DNA are transcribed to RNA. RNA is the molecule that is then translated to become proteins that carry out our physiological function. That is to say that the nucleus was thought to control health or disease. Researchers are now understanding that the mitochondria produce the energy or ATP that controls nuclear expression of DNA. Therefore, mitochondria are actually the source of control, not the nucleus. This idea will later be expanded upon in Chapter 7.

Additionally, the field of epigenetics is changing the landscape. Epigenetics is the study of how environmental exposures can influence gene expression (the proteins coded for by DNA) without changing the genetic code itself. This is the interface between the environment and DNA. A number of factors can have epigenetic effects, including (but certainly not limited to) foods, stress exposure, drugs, and illness. Epigenetic effects even extend to the past environment of your parents and their parents-- their epigenetic changes can be passed down to you. Health is therefore a result of the complex interaction between you, your environment, and the environment of your ancestors.[11] Current medical literature shows that it is the mitochondrial production of energy (ATP) that dictates much of what is happening in our cells and organs. Therefore, mitochondria are actually information processors, and not simply energy producers.[10]

In order to understand mitochondria as central controllers of health, it will be necessary to first understand the transition in medicine to quantum biology. Quantum means the smallest package of a physical property. For example, a photon is the smallest package of light. Within our inner workings are our organs, cells, DNA, proteins, molecules, and atoms with subatomic particles: protons, neutrons, electrons. We have these smallest of small particles within us. They make up every part of us. Within the field of quantum mechanics, the smallest packets of these particles can do some interesting and unexpected things. For example, light can behave as both a wave and a particle. Electrons can also behave like waves, and as such their exact location and speed can only be known as a probability. As a result, there is uncertainty in their behavior. These ideas make for an uncomfortable union with human biology. How can we not know exactly what is happening in the human body at any given time? How could our bodily functions inherently have some degree of uncertainty? Until recently, the field of quantum mechanics was thought not to play a role in the workings of the human body. The past few decades have changed that as we realize the biologists' oversight. At the current moment, if something is not founded in quantum physics it is becoming apparent that it has no place in human biology. Critical to understanding quantum biology is an understanding of quantum computing, considered by some as a mirror to our own cognition and even perhaps modeled after our cognition. It has been said that everything made by man is in the image of nature.

Over the past several decades there have been major advancements in our understanding of biology with regard to quantum physics. Included in these are the ideas that our brains function as quantum computers with consciousness held in our

microtubules (tiny "tubes" that form the structure for our nerves). It is proposed that the spin of atoms creates quantum coherence or a signal in our brains and bodies that allows us to perceive or hold consciousness.[12] At the same time, quantum computers have become a reality and continue to advance. Quantum computing dramatically increases computational power and while currently available only to few, it is predicted that individuals will have quantum computers in their homes within the next few decades. Upon seeing these comparisons, one wonders, if consciousness is held in the microtubules of our nerves or the spin of our atoms, could we reverse engineer the moment that the quantum code, qubits, soul or consciousness enters the body?

As we evolve on Earth, the question also arises: who are we as a species and where did we come from? Evolutionary biology tells us that about 1.45 billion years ago, we began to evolve with mitochondria and then developed increasing levels of sentience or consciousness.[13] We began as single-celled organisms and slowly advanced to become upright, walking, talking humans that interact with and control (to the best of our ability) our environment. We take cues from and respond to the physical world around us. We have evolved with the ability to see life in terms of classical physics: that which exists on the macroscopic scale and is easily observed, including movement and gravity. For example, if you want to eat a piece of fruit off of a tree, you reach out and pick it or you wait for gravity to pull it to the ground. While we perceive classical mechanics and gravity, we did not evolve to be aware of the level of interactions going on around us on the quantum scale, that which is smaller than the microscopic level. We cannot consciously perceive the strong force that holds atoms together or the spin of the subatomic particles that are responsible for consciousness. This is in part because evolution is dictated by survival of the fittest, and

procreation is the driving force. Whatever allowed us to feed ourselves, keep ourselves alive, and make babies is what was needed to allow the species to survive. The perception of quantum physics was not included or relevant for our survival.

Our eyes have evolved to see a very narrow portion of the electromagnetic field: the sun's light, the seven colors of the rainbow. We use it for sight and for our skin to transmit information for our biological function. We also use ultraviolet and infrared light that we cannot see. For example, our skin uses UVB light to make vitamin D, a vital nutrient and hormone that regulates our moods and immune systems. As explained in Chapter 8 in greater detail, sunlight regulates countless biological functions beyond vitamin D production.[4]

As we have evolved from the oceans to upright human beings on the verge of quantum computing and a revolution with artificial intelligence, the next questions we must ask ourselves are, where are we headed, what will it look like, and how will we get there?

In the short-term, we are headed toward a data-driven consciousness. We are all faced with tremendous amounts of information coming at us at every moment of every day. From cell phones to email to the biotracking devices we use to measure every bit of data about our bodies, we no longer have the ability to even remember all of our passwords to get us through the day. This is the short-term evolution. Our brain's capability to digest, interpret, and hold information. And with that we have this ability to communicate information almost instantaneously across the globe. We can use our phones to put our children to bed from the road. We can share thoughts and learn from each other over social media. Ideas spread like wildfire. Some of us even choose our partners via the internet. But there is a dark side to this as

well. People often have no hesitation to hide behind their screens and say cruel things without any concern for another's feelings or experience. All of this information is being recorded forever in the cloud of information that will one day be searchable and mined for data on any of us. What will we have to show for it? What will we as individuals and as a society have to show for ourselves? What will our children and grandchildren see of our online behavior when statutes of limitations expire, and they have access to see our recorded digital record? Will we like what they will see of us?

What will our long-term evolution look like? In 1964, a Russian astronomer named Nikolai Kardashev proposed an assessment of a civilization based on its technological advancements and ability to harness energy. It was originally developed to look at energy available for communication but has expanded to include total energy available. If we look to Kardashev for what theoretical physicists say comes next, it may surprise you. While it may seem like something out of a science fiction movie, this is what they predict will happen. The Kardashev scale outlines five levels of civilizations. A Type I civilization is able to utilize all of the resources of its planet. A Type II civilization can control the energy of its star system. A Type III civilization can harness its galaxy.[14] Kardashev himself stopped here, but other physicists have suggested Type IV and Type V civilizations. The energy available to a Type V civilization would include all of the energy not only in our universe, but in all universes in all dimensions of string theory. String theory, as will be discussed in Chapter 9, is a model of physics that assumes that tiny one-dimensional strings are coiled up inside the particles that make up our world. String theory predicts 11 dimensions as opposed to the 4 that we perceive (3 directions and time) curled up to the size of the plank

length. It is predicted that Type V civilizations will be pure energy beings and will exist billions of years in the future.[15]

If this idea strikes you as science fiction, take a moment to reflect on what the bacteria that evolved out of the ocean saw or thought. Could they have imagined with their limited understanding of the world around them-- the few millimeters in which their entire existence took place-- that one day, 1.4 billion years in the future, they would become the human race that we are today? Likely not. So, the future of us progressing to light beings without bodies should seem preposterous to us, as our current place in evolution would have seemed to the bacteria. Let's proceed with the thought of what comes next.

We are currently a Type 0 civilization. Kaku believes that we will potentially become a Type I civilization in the next 100-200 years-- that is, if we do not destroy ourselves first. We currently have minimal control of our planet and its resources. We sustain ourselves on the energy of dead plants and animals. We destroy our resources and ourselves. We are at the cusp of this transition and will need to work together on a global scale if we are to develop the technology to harness the power of our planet and our sun. While we cannot fathom what it would be like to be a Type I civilization, let alone a Type V, history shows that civilizations that are unable to work together destroy themselves over money, power, and religious differences. If we are to succeed at becoming the next level civilization, it will take an understanding of who we are and where we come from. The ability to see one another as the light that we are from the moment of our individual creation is the first step in this unity.

As we look toward the advancement of our civilization on a global scale, it is also important to ask the personal, human questions:

where do we as individuals come from and where do we go when we leave here? If, according to the first law of thermodynamics, energy and information can neither be created nor destroyed, where does our light come from before we arrive here, and where does it go? Let's start with where we as humans begin. It is our hope that if it can be scientifically demonstrated that we are each a spark of light that comes from and returns to the light, then this would allow us to be able to come together to care for each other and our planet and utilize the coming technological advancements to progress to a Type 1 civilization.

Chapter 3: Fertilization

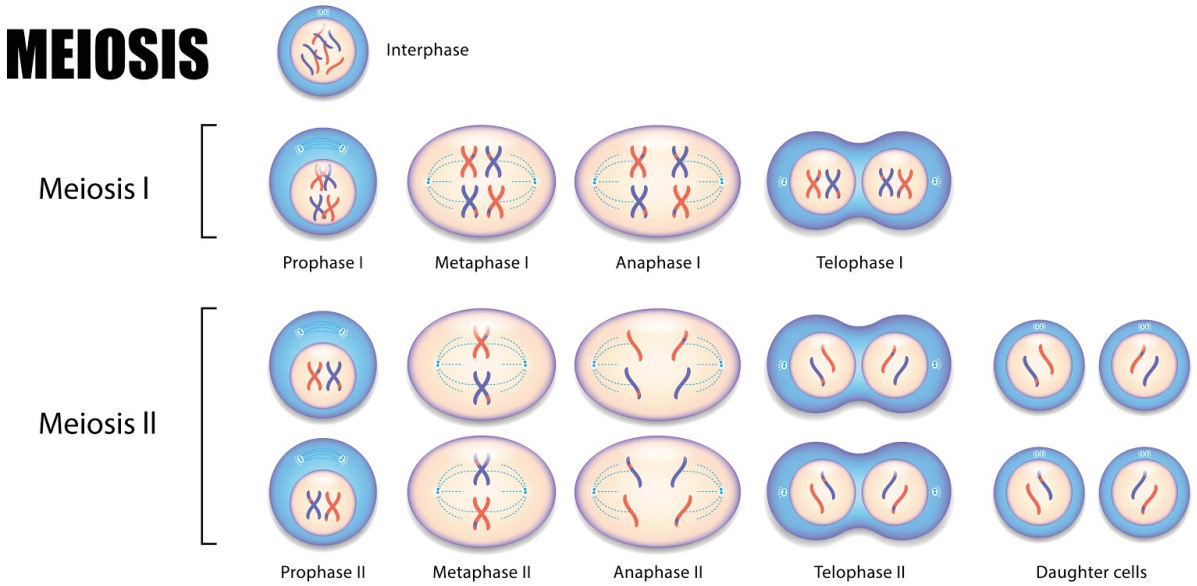
For years, we have known the physiology of how the sperm and egg meet. The field of reproductive endocrinology is becoming an ever more necessary and sought-after specialty as our infertility rates continue to skyrocket. According to the CDC, 10 in 100 women in the United States have trouble getting or staying pregnant. That's 6.1 million women between the ages of 15-44.[16] In 1978, *in vitro* fertilization (IVF) was developed and since then we have been sterilely removing eggs and sperm from human reproductive tracts, combining them in petri dishes, and growing embryos to be either placed in their mothers' wombs after several days of growth or cryopreserved for future use.

Each month, a woman ovulates or releases an egg from one of her two ovaries. When she has intercourse at the right time on what is usually the 14th day midway through her cycle, a flood of sperm washes into the vagina. They travel through the cervix and uterus, up into the fallopian tube to meet the one egg that was released to be fertilized that month. After the egg and a single sperm meet, the newly formed zygote tumbles down towards the uterus. It divides into two cells, then four, then eight, transforming into a morula, blastula, and embryo that burrows its way into the uterus for development into a full-term infant. In order to understand the complexity of this process and of the zinc spark, let's start with meiosis.

Meiosis

Cells divide through two different processes: mitosis and meiosis. Mitosis occurs in all cells within the body aside from gametes

(sperm and eggs). Meiosis is the mechanism through which sex cells divide. It has two different phases: meiosis I and meiosis II. DNA is replicated prior to meiosis I. This process is identical for eggs and sperm; however, the timing is dramatically different. Spermatogenesis (the production of sperm) begins at puberty in healthy males and continues through life, creating several hundred millions of sperm every day. Contrarily, it is widely accepted that egg production begins *only* while the female is a developing fetus, then stops. Though there are some studies in mice that show that new eggs may be made from stem cells later in life,[17] this has not yet been observed in humans, and it is believed that a woman is born with all of the eggs she will have during her life. The steps of meiosis are as follows (please also see diagram below):



Prophase I: Homologous chromosomes (two which contain the same genes: one set from mom and one from dad) line up and undergo crossing over, in which genetic material is "remixed", forming a unique combination of maternal and paternal genes.

Metaphase I: Chromosomes line up along the metaphase plate, or the equator of the cell. Spindle fibers, or microtubules, form and attach to the chromosomes and to each pole of the cell, acting as tethers.

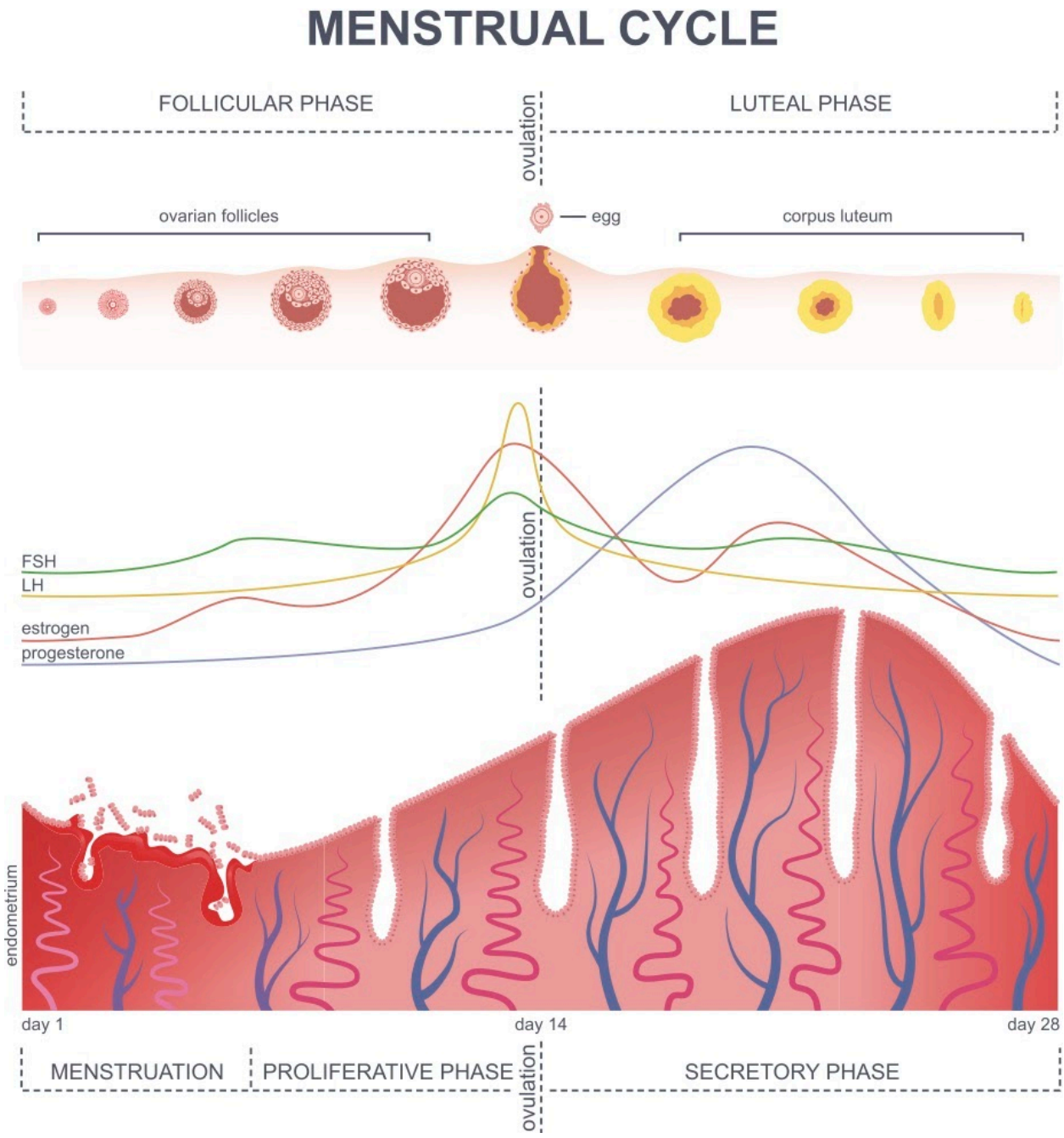
Anaphase I: Spindle fibers pull the chromosomes apart and they begin moving to opposite poles of the cell.

Telophase I: The chromosomes arrive at the two ends of the cell and nuclear envelopes reform around them.

Cytokinesis I: The cell membrane divides, forming two identical daughter cells.

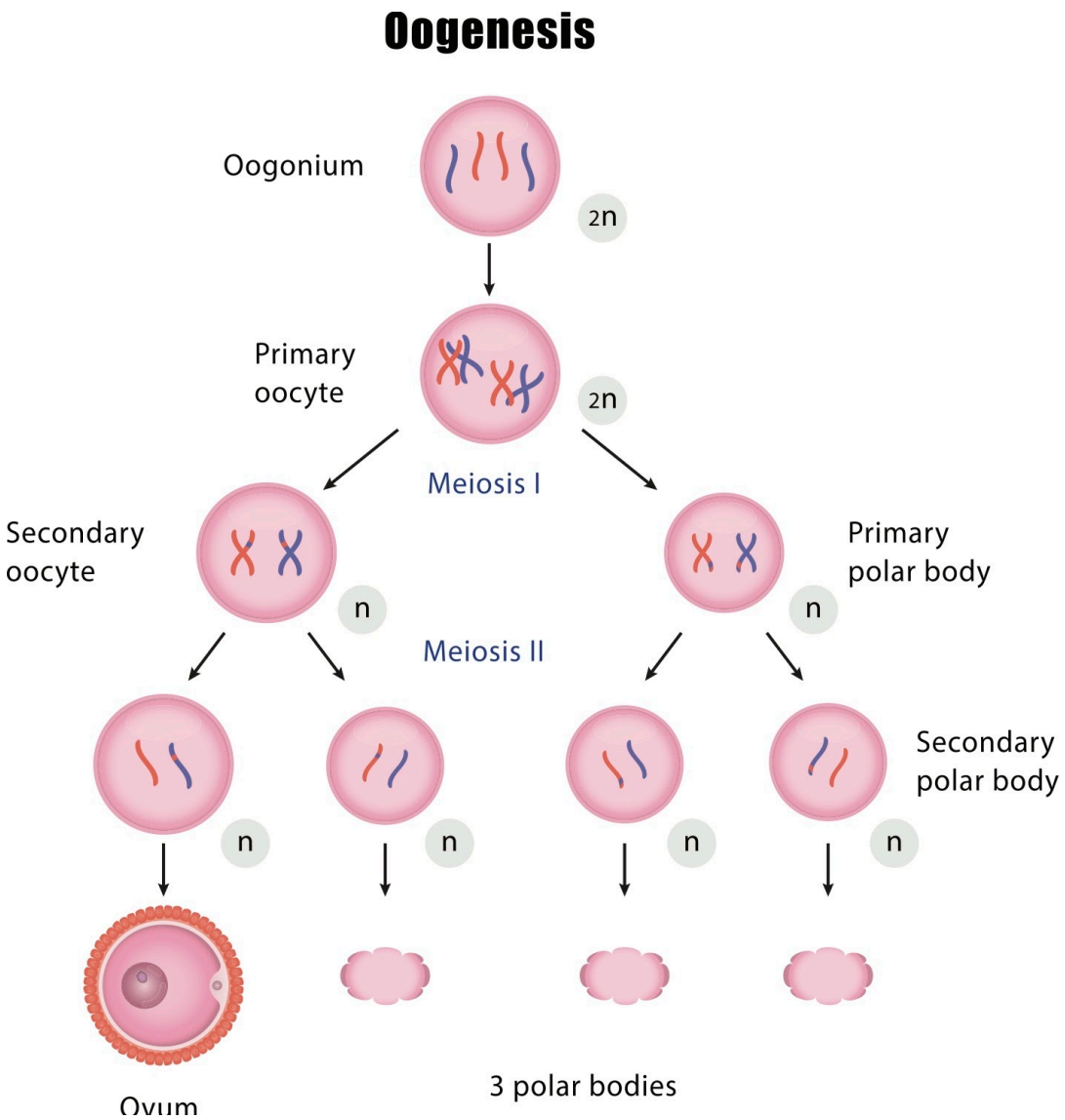
This process is repeated for meiosis II; however, the DNA is not replicated again. Rather than homologous chromosomes lining up, the sister chromatids (each half of the "X") split apart from one another and one goes to each daughter cell.[18]

Progression through oogenesis, or egg development, is highly regulated. When the female fetus is developing, her eggs are arrested at prophase I, where they remain for years, some of them for four to five decades-- her entire reproductive life. The immature eggs are stored in the ovary in arrested development through childhood until puberty. At this point, the young woman's brain begins secreting gonadotropins (hormones) called follicle stimulating hormone (FSH) and luteinizing hormone (LH). A monthly surge in these hormones causes one oocyte to resume progression through meiosis I and develop into a fertilizable egg the day before ovulation, or day 13 of her menstrual cycle.



At this stage, the egg is a primary oocyte and contains 46 chromosomes (the total number that a human being has in each cell). Because the egg will merge with a sperm, which contains 23 paternal chromosomes, half of the egg's chromosomes must be removed. To achieve this, during meiosis I the egg divides unevenly into a secondary oocyte, which contains half of the

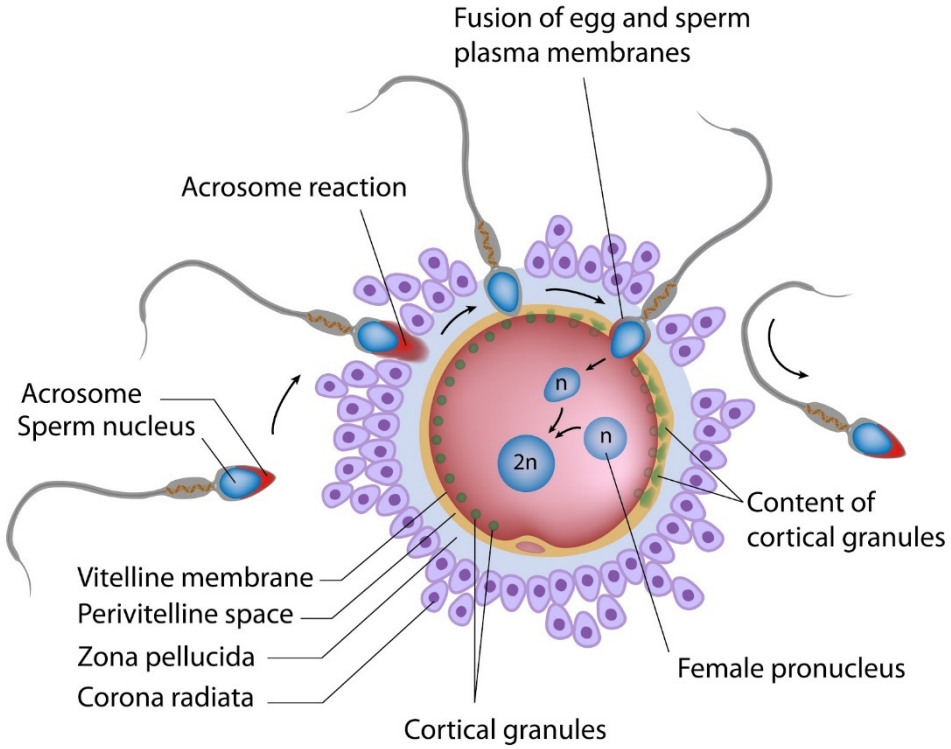
primary oocyte's chromosomes or DNA, and the first polar body, which is like a trash receptacle for the extra 23 chromosomes.[19] The secondary oocyte now has a single copy of the 23 maternal chromosomes and is prepared to meet her partner, the sperm, which contains 23 paternal chromosomes.[20]



Once ovulation occurs and the secondary oocyte is released into the abdomen, it is swept up by the fimbria or finger-like projections at the end of the fallopian tube, inviting it inside to begin its journey. The egg tumbles along, being pulled towards

the uterus by more microscopic finger-like projections called cilia. These are similar to a shag carpet, swaying in direction, coaxing the egg down the tube towards her mate.

During intercourse, millions of sperm are released into the vagina. They make their way through the cervix, into the uterus and up through the fallopian tubes. If this happens at the right time of the month, the lucky ones who make it to the tube alive race toward their target. While approximately 200 million sperm started out on the journey, only a fraction of them reach the tube.[21] Hundreds make contact with and burrow through the corona radiata, or the outermost protective layer around the egg, connecting with the zona pellucida (ZP), a protein layer surrounding the egg's membrane. While the exact mechanism is not known, the current model explored in mice exhibits human sperm binding directly to the zona glycoprotein ZP3, which acts like a lock that the sperm fits perfectly into. This binding triggers something called the acrosome reaction within the sperm head, it releases its enzymatic (digestive) contents, which were designed specifically to eat away at the hard, outer shell or crown of the egg.[22] The sperm then bind instead to a different receptor, called ZP2, which allows them to latch onto the egg and maintain physical contact, like a spaceship docking at a space station. The released hydrolytic enzymes digest a narrow fragment of the ZP, paving the way for one single sperm to fuse with the oocyte's plasma membrane.[23-25]



When the egg is "activated" by the sperm, it causes a rise in calcium inside the cell, which is released in waves from the endoplasmic reticulum (an organelle within the cell). It has been observed in mice that this calcium triggers the release of about 4,000 cortical granules or secretory vesicles into the egg, triggering hardening of the zona pellucida and preventing fertilization by more than one sperm (polyspermy).[22] This marks the beginning of many waves of increased calcium concentration. It is well-established that calcium oscillations play a critical role in the subsequent steps of egg activation, formation of the zygote, and ultimately the baby that is to come.[26,27] Additionally, the cortical granules contain ovastacin, a protein that cleaves or cuts the ZP2, one of the aforementioned ZP proteins, rendering them incapable of binding other sperm.[22] This means that when the sperm binds the egg, there is an attachment that locks it in and blocks all other sperm that are knocking on the door.

At metaphase II, just before the zinc spark, the egg contains an estimated 100,000 to 600,000 mitochondria. This is in stark contrast to the 50 to 75 mitochondria per sperm.[28] At fertilization, the egg has a higher number of mitochondria than any other cell in the body. This point will be further discussed when we review mitochondria in Chapter 7, and again when we discuss the energy transfer of consciousness into the zygote in Chapter 11.

The exact timing of human fertilization is a special and sacred moment: one that has historically been protected from academic research because most means of investigation cause disruption of the egg or the process of fertilization itself. This restriction has previously limited fertility research to animal models, however there are stark differences between animal and human egg cells--differences that have made in-depth knowledge of the human egg impossible until recently.

Zinc Spark

In 2011, Tom O'Halloran, PhD at Northwestern University had the thought that zinc may play a role in fertilization. O'halloran asked the leading expert in ovarian biology, Theresa Woodruff, PhD (who happened to be his wife) to help him study this. Their findings were nothing short of remarkable. O'Halloran and Woodruff began by studying mouse eggs due to the sensitive nature of human embryos. Emily Que, PhD, then a student in their lab, designed a probe that would identify zinc's movement through the egg. They discovered that the fertilization-induced calcium oscillations trigger a massive release of zinc from the egg-- a process termed the 'zinc spark'.[26]

First, they were able to show that 24 hours prior to ovulation, as the meiotic progression occurs from prophase I to metaphase II, the egg takes in approximately 20 billion zinc atoms, increasing its zinc content from 40 billion to 60 billion atoms in preparation for fertilization. This happens just before the egg is released from the ovary. This is a massive amount of zinc. This amount of metal is unparalleled in any other cell in the body. This 50% increase in intracellular zinc atoms is stored in granules along the periphery of the egg, away from the maternal chromosomes. They also observed that when the sperm and egg merge, there are fertilization-induced calcium oscillations that trigger the massive release of zinc from the egg-- the zinc spark.[27] This zinc release is the hallmark of fertilization in the mouse model.

Human eggs have long been known to contain zinc transporters and enriched zinc vesicles, indicating that zinc plays a critical role in the transition from gamete to zygote in humans. However, due to previous restrictions on experimentation with human eggs, it was not until 2016 that the same researchers showed that this efflux of zinc was experimentally observed in human eggs. In normal fertilization of a human egg, the sperm activates a release of calcium inside the cell. In order to study this, researchers injected calcium ionomycin directly into the egg to bypass the need for sperm activation. Ionomycin is an antibiotic that binds calcium and is used as a means to allow transfer of calcium into and out of cells for research purposes. They highlighted the zinc and calcium with fluorescent dyes and found that there was a marked release in zinc from the cell within seconds of calcium injection. The bigger the calcium injection, the bigger the zinc spark. This means that the size of the calcium waves is positively correlated with the magnitude of the zinc release. They then went two steps further to confirm what they had found. They injected the eggs with ionomycin alone (an antibiotic without bound

calcium) and a male specific complementary RNA (cRNA). This male cRNA or synthetic RNA triggers the calcium oscillations as a normal sperm would. They both revealed similar zinc sparks. Interestingly, there was variation in sparks between different murine eggs suggesting differences in egg quality.[26,29] This experiment was conducted using 3D live-cell imaging. A bright fluorescent green probe measured zinc inside of the egg and a different fluorescent red probe measured zinc outside of the egg. These probes do not mix. Intracellular calcium levels were increased using an injection of exogenous calcium into the egg. Within ten minutes, billions of zinc atoms were released in a magnificent zinc spark. As red and green intermixed inside the cell there grew a yellow flash and then a red spark or halo of zinc moved outside, away from the cell.[26] This zinc spark is the announcement that the egg has been successfully fertilized. The calcium transients that initiate the spark move across the cell at over 250 mph, while the zinc wave progresses very slowly. Experimentation conducted by O'Halloran has demonstrated that a portion of the zinc is released during the zinc spark and the rest of it is, to quote O'Halloran, "sent in as a resounding wave, setting up a harmonic in the cell [or] a chemical prelude to the complex developmental events that are going to have to proceed in a spatially defined manner from this one small sphere into a thousand galaxies of cells."[30]

These synced calcium oscillations and massive coordinated release of zinc via cortical granules (small packages within the egg) are in time with activation of the egg and the previously mentioned cortical reaction, which results in the hardening of the zona pellucida and cleavage of ZP2, preventing fertilization by more than one sperm.[31] Therefore, the zinc spark is integrated and supported by previously established knowledge that calcium

transients dictate meiotic progression. The massive zinc spark that is seen is the signal that the zygote has formed.

For ethical reasons, it is not possible to show a direct relationship between the dynamics of the zinc spark and future embryonic development in humans. However, in mice, the bigger the zinc spark the better the quality of the embryo that develops.[29] In the future, enhanced understanding of the physical and chemical effects of zinc will help us further assess the quality of the embryo. Differences in the calcium and zinc levels suggest there are differences between zygotes based on these factors. In O'Halloran's lab, researchers are currently making strides to better understand the zinc spark in a manner that would do no harm to a human zygote, as any attempt to measure zinc outside of the ovary via dye or photons for imaging could be detrimental. Additionally, O'Halloran has recently shared that their lab is trying to identify photoacoustic or auditory proof of the zinc spark. Photoacoustics utilize light beams to excite molecules and ultrasound to transmit sound waves, enabling one to "hear" emitted light. To date, we can now "see" the spark that signifies the moment that the transition happens from sperm and egg to the newly formed zygote. If or when identified, the photoacoustic sound will be the "ring" of the newly formed zygote.

The zinc spark is a revolutionary discovery for multiple reasons specific to reproductive biology. In our world of increasing infertility rates, the measurement of the zinc spark has the potential to be used by embryologists and reproductive endocrinologists, or infertility doctors, to determine which embryos to transfer or use for in vitro fertilization for the best possible chances of successful pregnancy.[29] It could eliminate the need for prolonged embryo culture and multiple embryo transfer. The longer an embryo is cultured or grown in the lab, the higher

the risk of loss. Even more so is the risk to mother and baby of multiple embryo transfer, meaning twins, triplets, or more. This is done in hopes of achieving at least one viable pregnancy. This multiple embryo transfer could potentially be eliminated if we can reliably use the zinc spark to predict the best embryo.

As the halo of zinc explodes out of the egg, something else revolutionary appears to happen. It is at this moment of fertilization that the consciousness, or quantum code, enters the zygote which will develop into the embryo, then the fetus. The physics of this quantum code will be explained in Chapter 6. For now, let's say that energy is information, and the information that makes you is called from the field and trapped in the zygote at the moment of the zinc spark.

Let's look at the images of the black hole and zinc spark. It is striking how similar in appearance the zinc spark is to the halo Einstein predicted of a black hole. The first image is a photograph of a black hole, taken by researchers at MIT in April 2019. As nature often follows a repeating pattern or golden ratio the similarity between the event horizon of the black hole and the "event horizon" of the zinc spark is uncanny. As above, so below. While the actual image of the zinc spark could not be included due to copyright restrictions, this is an illustration similar in appearance. A video of the zinc spark captured in O'Halloran's lab can be found at: https://vimeo.com/114680729

Please take a pause to watch this video. It is truly amazing.

Left image: first visualization of a black hole.
By Event Horizon Telescope - https://www.eso.org/public/images/eso1907a/ (image link) The highest-quality image (7416x4320 pixels, TIF, 16-bit, 180 Mb), ESO Article, ESO TIF, CC BY 4.0, https://commons.wikimedia.org/w/index.php?curid=77925953

Right image: a rendition of the zinc spark. The original can be found at https://www.sciencefriday.com/articles/picture-of-the-week-zinc-spark/

Resumption of Meiosis

Once the mass exodus of 20 billion zinc atoms occurs, there is a resumption of meiosis, or progression of the DNA to begin the development of the zygote.

Said simply, the zinc atoms in the egg have been holding a brake on the proteins that allow the egg to proceed through meiosis, like applying the brakes of a car. Once the sperm binds the egg and the zinc explodes out of the cell, the brakes are released, and the egg is free to progress from metaphase II to anaphase II as described below. Meiotic progression occurs.

Scientifically, the abrupt decrease in intracellular zinc concentration modulates the advancement of the egg through meiosis, leading to zygotic development. Up until now, the cell was in metaphase arrest. A well-known mechanism of meiotic arrest acts via cytostatic factor (CSF) EMI2, which competitively inhibits anaphase-promoting complex/ cyclosome (APC/C), an E3 ubiquitin ligase, from facilitating progression through meiosis II. EMI2 is bound and activated by zinc atoms, thus the rapid reduction in zinc results in deactivation of EMI2, activating APC/C and thereby releasing the cell from metaphase II arrest.[32]

Until the discovery of the zinc spark, it was thought that transient calcium levels themselves were responsible for release from meiotic arrest, however there has been recent experimentation with artificial zinc chelation (metal removal) in mouse oocytes in the absence of calcium oscillations, in which successful fertilization and embryogenesis were obtained.[33] These results suggest that it is the zinc spark or decrease in zinc inside the cell itself that is responsible for the cell's progression through meiosis and on to a successful zygote.

Upon resumption of meiosis in the egg, half of the remaining sister chromatids or DNA are segregated into a second polar body (or trash receptacle) and the female pronucleus (the DNA hub of the cell) is formed. Just like the first polar body, this second polar body is usually degraded.[25] The male and female pronuclei which each contain haploid genomes (23 or half of the chromosomes) move toward each. Simultaneously, the sperm genome, which was tightly compacted in the sperm head, undergoes re-packaging.[34] At the same time, the maternal chromosomes prepare to meet with those of the sperm. The male pronucleus, which contains the sperm's DNA, moves toward the female

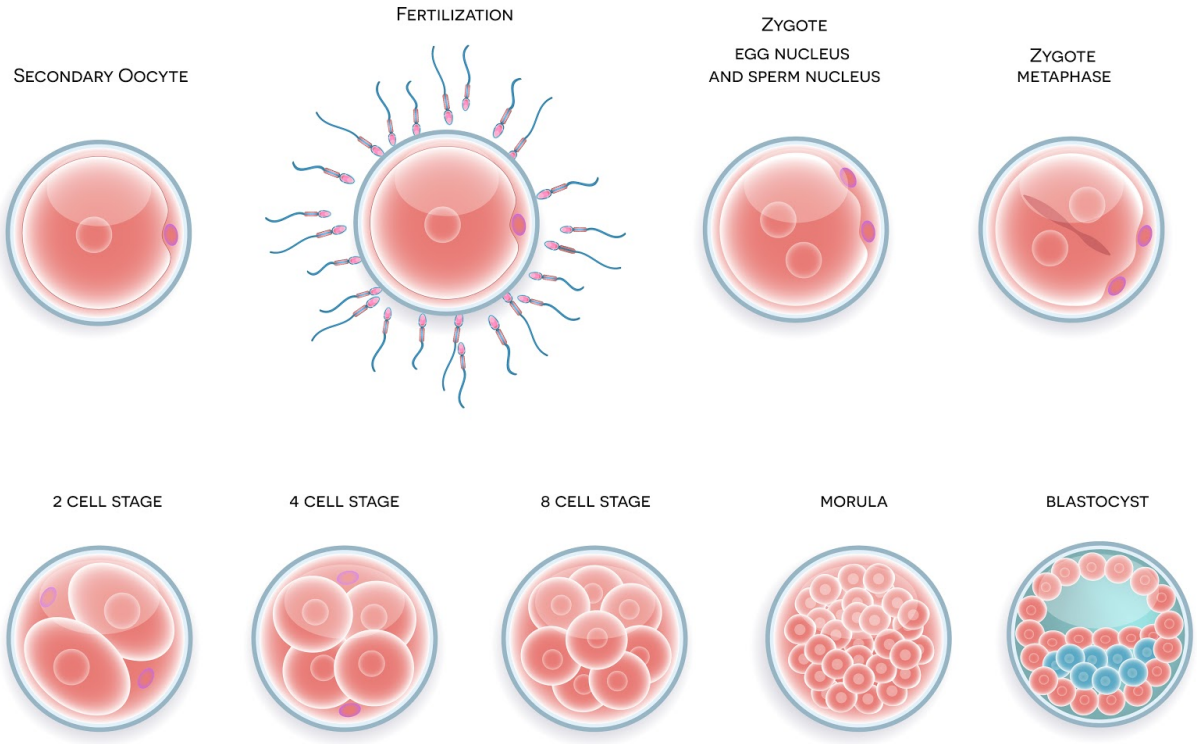
pronucleus and the two merge, placing the DNA from each in close proximity to one another. Prior to the DNA combining, there are some important transitions that must occur.

While both pronuclei have formed, there are stark differences in DNA methylation patterns that must be resolved in order for the male and female genomes to fuse into one zygotic genome that can successfully replicate.[35] DNA methylation is a mechanism of epigenetic changes in which methyl groups, which are composed of one carbon and three hydrogens (CH_3), are added to the DNA. This alters gene expression without changing the DNA sequence itself. These epigenetic changes can be inherited or acquired, dependent on lifestyle, disease, and environmental exposures. Because of the differences in DNA methylation patterns, each parental genome must undergo global DNA demethylation in order to reprogram the epigenetic changes and form a single totipotent zygote. However, this demethylation must not go to completion. Within the genome are several imprinted loci (locations of genes) that are solely expressed by one of the parents and are protected against demethylation.[36]

These methylation patterns are thought to hold DNA memory, and the global erasure of this is potentially why a zygote will have no memory of its past.[37] Initially after the two haploid genomes merge, the zygotic genome is silenced. Cellular processes continue to be governed by maternal messenger RNAs while reprogramming occurs. Messenger RNA (mRNA) is the molecule that carries the code from the DNA to be transformed into proteins that carry out cell function.[36]

42 hours after fertilization, the zygote will have replicated into four cells, and at 72 hours, eight cells. In the morula stage (in which the embryo is composed of 16-20 cells) the embryo is

swept along the tube by tiny fingerlike projections called cilia. It reaches the uterus after approximately five days. It has been evidenced in animal models that after 48-72 hours, the maternal-to-zygotic transition begins, in which maternal messenger RNA begins to be degraded and transcription of the zygotic DNA begins.[38] During this phase, the embryo undergoes mitosis with increased length of gap phases (time between mitotic cycles), in order to allow the cells ample time to grow. After a number of cellular divisions, the embryo progresses to become a blastula. At the blastula stage, contact is made with the uterine wall and it burrows deep into the uterine lining guided by CB1 receptors or endocannabinoid receptors to begin to receive its nutrient support from the mother's uterus.[39] During this process gastrulation begins and the cells migrate to the three different germ layers of the embryo: the endoderm, ectoderm, and mesoderm. These different layers consist of stem cells that will ultimately develop into all of the different anatomical components of the fetus. By the 28th day after fertilization, the neural tube along the baby's back is closing. This is the tube that will become the brain and spinal cord.



The stages of embryonic development.

Up until 11 weeks of pregnancy, glands in the mother's uterus supply the embryo with the energy and nutrients that it needs to grow.[40] This continues until the fetus is too large to be supported by the uterine wall, at which point the blood and nutrients are supplied by the placenta. Earlier transition to a nutrition and oxygen supply from the umbilical cord would result in too high a pressure through the cord that would result in expulsion of the embryo from the uterine wall. Once the umbilical cord develops, the embryo is fed by the placenta until it grows to 40 weeks gestation. At that point, complex coordinated uterine contractions begin to occur and labor ensues.

If the zinc spark signifies the moment that the sperm and egg merge and the zygote is present, what exactly are we seeing here and where is it coming from? Could this be the moment when consciousness enters the body? In order to understand this, let's look to the current state of quantum mechanics in human biology.

Chapter 4: Evolution of Consciousness

Quantum physics appears to be the playing field where philosophy and science meet. If we define sentience or consciousness as one of the great theoretical physicists, Michio Kaku, PhD, does, we have evolved out of the oceans with higher and higher orders of sentience or ability to receive signals from the environment and to react based on those signals. According to Kaku, "consciousness is all the feedback loops necessary to create a model of yourself in space, in relationship to others, and in time, especially forward in time".

From single celled organisms on the ocean floor to our evolution on land, what drives evolution is procreation, or the ability to make offspring. We would have needed to escape death by running from predators, feed ourselves, and have intercourse to evolve and perpetuate our species. In order to do so, we have had to evolve with the ability to receive signals from the environment, specifically from light via electron excitation of DHA in the retina, as will later be explained. Along the course of evolution, this allowed us to develop larger brains, the ability to make ATP or energy in our mitochondria, and in turn the capability of memory storage or perception of time. Additionally, it behooved us to see the classical physics in the environment, the apple falling, but it was of little value for running from a predator or having intercourse to perceive the quantum portion of the universe. This means that while we were consciously aware of the macroscopic or classical physics, the quantum portion was there all along, fueling our subconscious existence but below our level of perception. Sir Roger Penrose, a mathematical physicist and philosopher, states that consciousness is not a mechanical or computational byproduct that a machine could do. Rather, he believes that the answer to consciousness may be found deep

within the realm of quantum mechanics, and that in order to understand consciousness, we must first heighten our understanding of physics.[41]

This particular topic of consciousness and our environment is the focus of Don Hoffman, PhD, a leading cognitive psychologist and researcher in the field of visual perception and evolutionary biology who presents the idea of simulation theory. Hoffman describes our interaction with our environment as a simulation, as if we are only interacting with icons on a computer.[42] His work is in the field of optical neuroscience with his driving question being "are we machines?" He believed science pointed him in that direction growing up, but his father was a minister and his religious upbringing said no. He set out to find the answer.[43] Have you ever asked yourself the question, "how do I know that just because I see a color as blue, that is how others see it, too?" Perhaps another sees orange and has just gotten used to calling it blue. Along these lines, Hoffman has studied a subset of women whose fathers are color blind and who have additional cones. This is a condition called tetrachromacy. These women see additional colors that the rest of the population does not. In essence, they see a different range of the visual spectrum. Some of them are completely unaware that their vision is any different. He uses these women as an example of how some people perceive a different color reality than others. Information about that environment can be coded in those differences in color so that these women perceive their reality differently.

Our sensory perception is basically restricted to only a narrow spectrum of the electromagnetic field (EMF), or the 0.0035% that we have evolved to see, and excludes the rest of the EMF as well as all quantum phenomena.[44] We are oblivious to what is really going on because it doesn't serve our needs for survival and

evolution-- finding food and making babies. Thus, there could be an unlimited number of things going on around us that we cannot perceive. Hoffman uses the comparison of icons on a computer. We see the icons, but have no perception of the inner workings of our computers or the virtual cloud. They are not visible to us or even on our radar of existence.[42,45]

For example, we use our phones to type a text message, we are seeing only a tiny portion of what is involved in carrying out the task: only what we need. The pixels are arranged to display a keyboard, like icons symbolizing the series of 1's and 0's transmitted when we touch each key. Why? Because this is the most efficient system. If we were presented with the reality of what is going on in our phones and computers, most of us would be incredibly overwhelmed. Furthermore, if we were able to navigate what we were presented with and accomplish our objective, it would take much, much longer. In summary, the reality is hidden. This mirrors our evolution without the ability to perceive quantum physics-- it prevents us from being inundated with information that is not vital for us to know.

If you think of the movie *The Matrix*, we have evolved to see Neo and Trinity, but not to perceive the countless amount of binary code or quantum information that exists around us or inside of us. This amount of data, if brought to conscious level, would be overwhelming.

Our consciousness has evolved in order to interact with our environment and to perceive the world around us. Over the course of evolution, we have developed bigger brains to receive signals from the environment, for example, the electromagnetic field, through sensory perception. In doing so we have evolved to see or perceive classical physics (big picture), but not the

quantum makeup of our environment. The driving force has been survival and procreation. Based on the small portion that we perceive, which drives our reality and our evolutionary success, there is potentially an unlimited electromagnetic spectrum and quantum world that we do not see. We have evolved with limited perception from our five senses. This allows our brains to reconstruct the information around us with a very narrow perception of what's really happening.

Chapter 5: Quantum Mechanics and Biology

Just as we look up into space on a starry night and attempt to comprehend the distance between the stars and galaxies, the same concept of space exists on the opposite end of the scale. Within the atoms that make up our molecules is an unfathomable microcosm, just like the universe that extends beyond Earth: the infinitely large and the infinitely small. Quantum mechanics is the field of physics that describes how things in our world work at the smallest level, like a microscope beyond atoms to the subatomic particles-- electrons, protons, neutrons-- and even deeper to what makes up those subatomic particles. To understand this scale, think of an atom as an Olympic stadium. In this model, the nucleus would be the size of a hummingbird, floating in the vastness of an amphitheater that surrounds it. Scientists have developed a scale, called the Planck scale, to define the smallest unit of measurement for time, length, mass, temperature, and charge. Anything smaller than the Planck unit is inexplicable by our current laws of physics. At this level, it is expected that the quantum effects of gravity emerge.

Prior to the discovery of quantum mechanics in the 1920s, only classical physics was used to describe the properties of matter and energy. Classical physics is concerned with phenomena at the level we can see or perceive with our senses, describing gravity, motion, and temperature. However, in the 1920s it was discovered that the laws of classical physics fail to apply to particles at the extremely small level or those with incredibly high velocities. According to classical physics, objects can only occupy one space at a time, must have sufficient energy to overcome barriers, and cannot travel faster than the speed of light. Quantum mechanics changes the game. Developed by Niels Bohr, Albert Einstein, Maxwell Planck, and others, quantum mechanics

forms new rules to explain existence at the smallest scale. At that level, matter has only a probability of being in a particular place at one time. Light behaves both as a particle and as a wave. The spectrum is no longer continuous, and things are divided into the smallest of packets, or quantized. Quantum field theory describes these phenomena and included in this is the Standard Model, an entire table of particles that make up subatomic particles. This will be further discussed in Chapter 9.

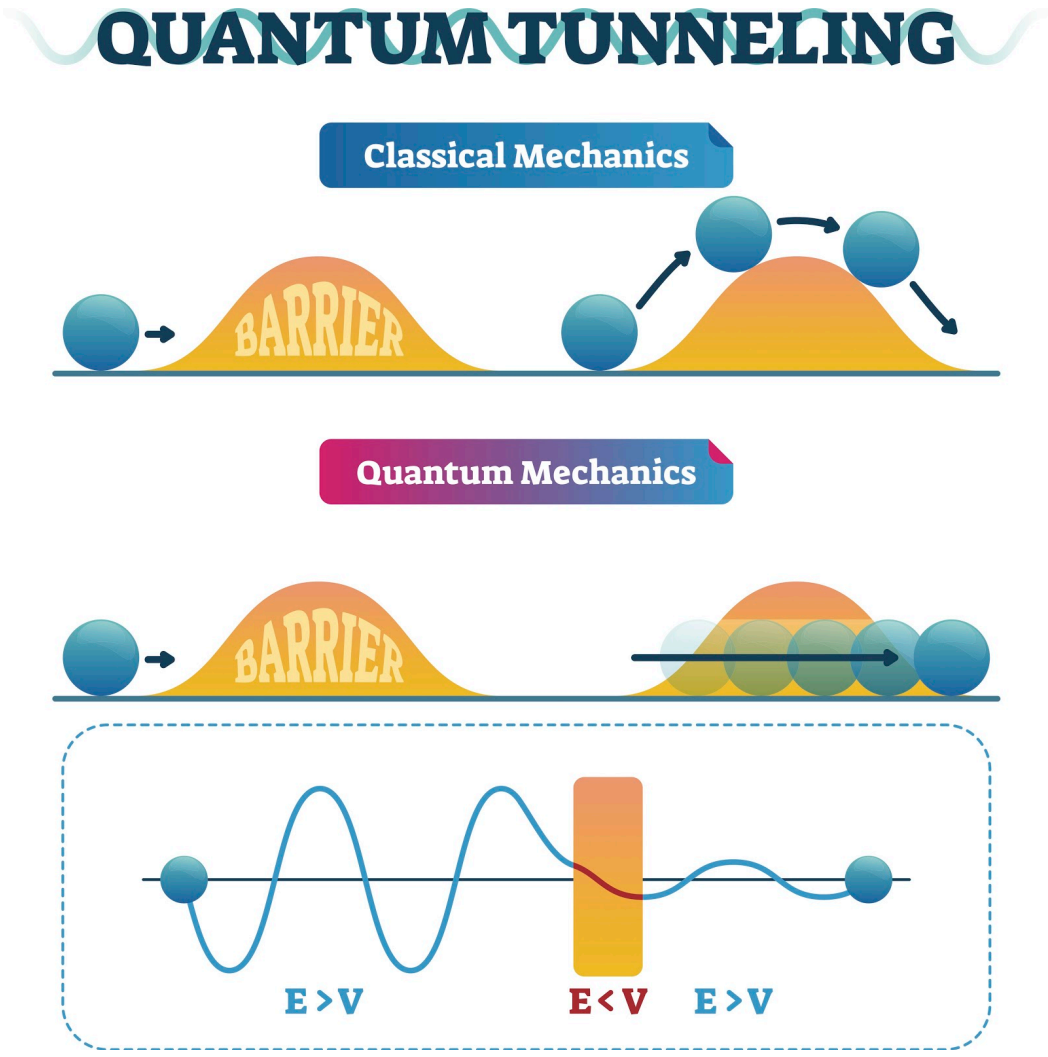
Quantum mechanics was previously disregarded in biology. It was thought that bodies existed at temperatures that were "too warm and too wet" for it to take place. Phenomena founded on quantum principles were viewed to occur only in extremely cold, dry environments. However, in recent years these mechanisms have been observed in key biological processes including bird migration, enzyme reactions, photosynthesis, olfaction or sense of smell, and proton tunneling in DNA mutations. These remarkable discoveries have led to the idea that quantum physics also operates in cognition and consciousness. As a physician studying nutrition and the effects it has on our mitochondria and our genetics in an effort to more deeply understand how to heal people of modern diseases, I began to realize the effect light and quantum physics have on our energy production and therefore our DNA. That realization led me to the search for the moment that consciousness enters the body. At the same time, I was studying these things, I began searching for references to light in the Bible and the Quran and realized that there could be a place where science and religion meet-- that they describe the same thing. Let's further define quantum phenomena in order to understand this connection.

There are three primary quantum phenomena which we will refer to in this book: quantum tunneling, quantum entanglement, and

quantum coherence. While these processes do not exist in classical physics and we cannot readily perceive them, they are integral to quantum physics.

Quantum Tunneling

In classical energetics, a particle cannot travel from point A to point B through a barrier without exerting the energy required to overcome such a barrier. Quantum tunneling is the process where a quantum (subatomic) particle traverses a potential energy barrier that is higher than its own kinetic energy. In other words, tunneling allows the particle to travel *through* its obstacle, rather than over it.[53] This would be akin to a boulder that needed to be moved to the other side of a mountain. In classical physics, the only option would be to expend a significant amount of energy to push it up the mountain and let it roll down the other side. However, if the boulder were to follow the jurisdiction of quantum mechanics, there would be some chance that it would move straight through the mountain without having to go over it, expending little energy. This is quantum tunneling.



Subatomic particles passing through a barrier. The particle has a finite probability of crossing an energy barrier.

Tunneling is possible because the precise location of a quantum particle at any given point in time exists as a wave-like probability. Its likelihood of occupying a particular space can be predicted using the Schrödinger equation. This equation uses conservation of energy (kinetic energy + potential energy = total energy) to give a wave function that contains all of the known information about where a particle may be in space.[53] The

probability of quantum tunneling occurring is dependent on the energy and size of both the particle and the barrier, exemplifying why this process is deemed not possible in classical physics wherein the objects in question are far too large to tunnel. While it was previously disregarded, recent experimentation has demonstrated that quantum tunneling is not only possible at physiological temperature, but proton and electron tunneling occur ubiquitously throughout crucial biological processes, including photosynthesis, olfaction, DNA mutations, and enzyme reactions.[54]

Judith Klinman, PhD has demonstrated in her laboratory at the University of California, Berkeley that enzyme reactions are dependent on quantum tunneling. Enzymes are proteins that act as catalysts, enabling otherwise improbable reactions that are critical to sustaining life. Her group proved that hydrogen tunneling occurs at room temperature. As a result of her work, quantum tunneling is now accepted as the mechanism for all major classes of enzymatic C-H cleavage, or the breaking of carbon-hydrogen bonds.[55,56] C-H bond cleavage is necessary for a multitude of biological processes, including the ability to release chemical energy by breaking down ATP molecules.

Tunneling in DNA Mutations

Quantum tunneling is involved in genetic mutations. DNA is the molecule that stores information and the code to carry out life, like the blueprints or instruction manual for every cell in your body. There are four bases that make up the language of the genome: adenine (A), thymine (T), cytosine (C), and guanine (G). A pairs with T and C pairs with G, fitting together like puzzle pieces held in place by glue, or hydrogen bonds. In order for these base pairs to line up, the notches and knobs of the puzzle

pieces must be in perfect alignment. The pairs are stacked upon each other like rungs of a ladder, forming a double helix (twist) of DNA. When cells divide, the DNA must also be replicated. As the DNA untwists, the glue holding the puzzle pieces together dissolves and they are free to disconnect laterally, forming two independent strands. These unmatched pieces then fit with new partners, identical to their last. If there are any deviations in the structure of the puzzle pieces, they cannot be properly bonded and mutations (errors in the code) can occur. There are potential energy barriers preventing structural deviation, meaning that there are energetic roadblocks to prevent the knob of a puzzle piece from migrating away from its position. This is where quantum tunneling comes in. Protons are able to tunnel from one place to another regardless of the barrier, like a notch of a puzzle piece shifting slightly out of place. This alteration in chemical structure changes the configuration of the piece so it's no longer able to fit with its complement. The bonds are unable to properly form, resulting in mutated DNA and therefore altered protein production. This altered protein production affects the phenotype or symptoms and can lead to disease, including cancer.[57]

Tunneling in Olfaction

Olfaction, or the sense of smell, is also dependent upon electron tunneling. Airborne odorant molecules from food, perfume, etc., interact with receptor proteins inside of your nose. The odorant molecule and its receptor fit together like a key fits into a lock, and it was originally thought that this structure alone is what transmits the signal to tell your brain that you were smelling a flower, cookie, or apple. However, it is now recognized that this process requires quantum mechanics. When the odorant molecule binds to its receptor, electrons tunnel between the two. An electron from the odorant molecule loses energy during

tunneling, and the odorant's vibrational frequency matches the energy difference between the odorant molecule (electron donor) and the olfactory receptor (electron acceptor). By tunneling, the electrons are able to trigger signal transduction, or the conversion of the odor to the electrical impulses that allow your brain to sense and distinguish between different smells.[58,59]

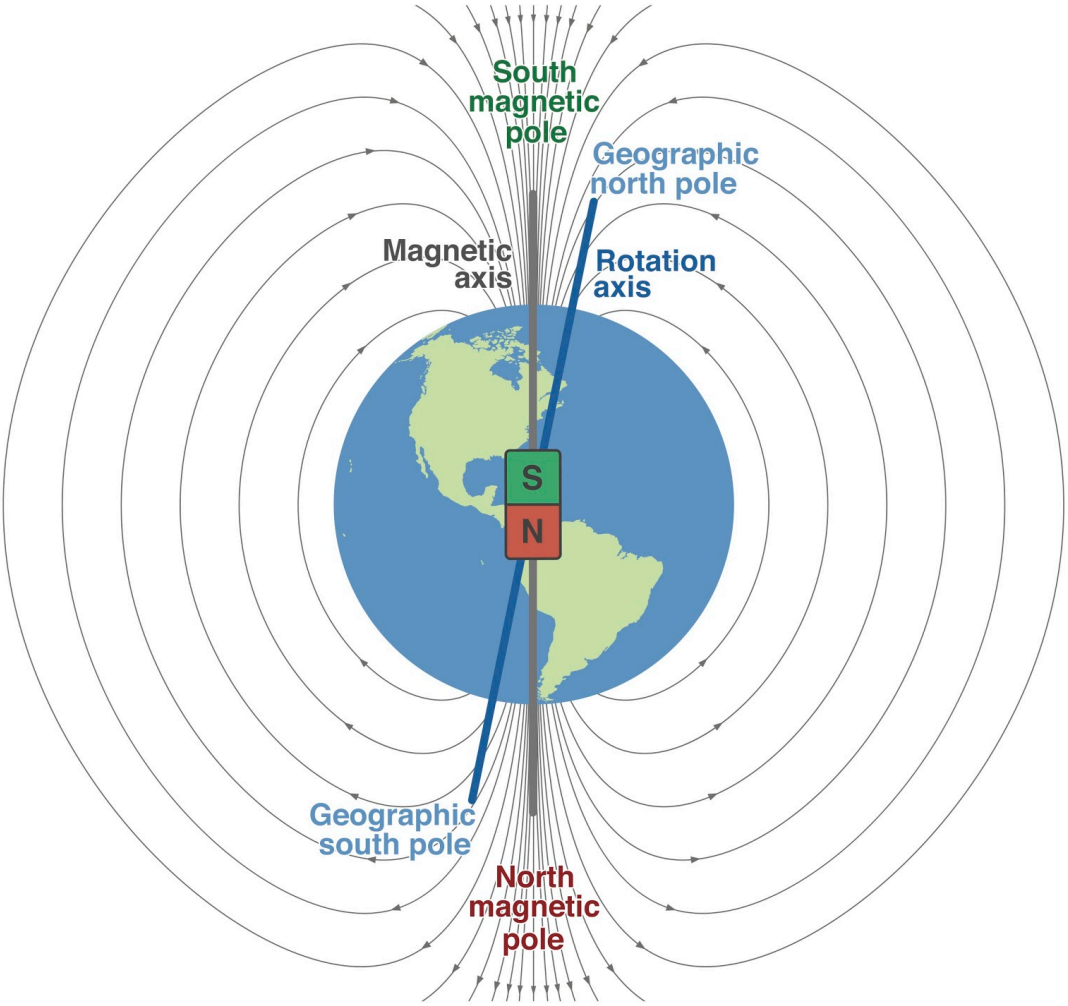
Quantum Entanglement

Another fascinating feature is what Einstein called "spooky action at a distance", quantum inseparability, or non-locality. This means that all quantum objects that have interacted at one point are in some sense still connected and can affect each other across space. This non-local connection is quantum entanglement and was first described by Einstein, Podolsky and Rosen (EPR) in their famous paper in 1935, "Can Quantum-Mechanical Description of Physical Reality be Considered Complete?"[60] Similar to tunneling, entanglement may at first seem impossible given our limited perception. When one quantum system has interacted with another, their waves become entangled so that when one collapses, the other collapses instantly. Think of this as two waltzing couples performing the same but opposite choreography across a dance floor. When one couple spins one way, the partner couple instantly spins the other way. It does not matter if they are across the dance floor or across the world from each other. We will further expand upon spin in Chapter 6, but for now realize that there are two possible spin states a subatomic particle can have: spin-up and spin-down. When two particles are quantum entangled, if one is spin-up, the other will intrinsically be spin-down. Quantum entanglement can also occur across time, called temporal nonlocality. Mathematically, quantum entanglement is supported by Bell's theorem, which explains that objects that are quantum entangled cannot be explained by any

theory of locality. The principle of locality would mean that an object is directly influenced by its surroundings. Further, it supports the EPR argument that two quantum entangled particles can influence each other across space or time in a manner that is faster than signals could be transmitted at the speed of light.[61] In the past few decades, entanglement has been demonstrated in bird migration, photosynthesis, and many other biological functions.[54]

Quantum Entanglement in Bird Migration

Every year, about 3.5 billion birds in the United States fly South for the winter. They journey thousands of miles away, but somehow remember exactly where they came from months later when they migrate North again. How do they know where to go? Through quantum entanglement with Earth's magnetic field. Earth has a giant magnetic field, extending from the geographic North pole to the South pole, as if there were an enormous bar magnet at its core. Birds that migrate essentially have magnetic compasses within their eyes, which are dependent on light. The bird's retina contains a light-sensing protein called a cryptochrome. When a photon (specifically of blue light) excites the electrons within the cryptochrome, it creates quantum entanglement between electrons in two molecules within the protein. This induces a highly unstable excited state that allows the bird to detect the very subtle magnetic field of Earth, determining its geographic location with respect to its destination.[62,63] Additionally, this "quantum compass" allows birds to navigate flight during stormy and cloudy weather when sight is obstructed.[64] The study of entanglement in bird migration, originally written off, further opened the door to the possibility that quantum mechanics are at work in biological systems.



Earth's magnetic field extends from the magnetic north pole (geometric south pole) to the magnetic south pole (geometric north pole).

Quantum Coherence

Quantum coherence goes hand-in-hand with quantum entanglement and again is founded on the principle that all particles have wave-like properties. If the wave-like characteristic of an object were split into two, these waves would interfere with one another coherently. Rather than forming two separate waves

with unique properties, the two waves would superimpose upon each other and form a single coherent wave. As will later be discussed, quantum coherence is the foundation of quantum computing, which utilizes the superposition of 0 and 1 states to dramatically increase computing power from the singular 0 and 1 states of binary code.

A simple analogy for quantum coherence is a marching band at the halftime show of a football game. When all members of the band march in unison and follow the choreography, the band plays a coordinated and spirited song like a symphony that ignites the crowd. The synchronous marching legs of the band members are akin to quantum coherence, while the separated members following the choreographed routine could be likened to the quantum entangled state of particles where one band member on one side of the field is connected to or acts in line with another member on the opposite side of the field. When one member turns right in one end zone, the partner turns left in the opposite end zone. When the entire band is marching (coherence) and moving through the choreography (entanglement) they instantaneously make magical music across the field.

Quantum Coherence in Photosynthesis

Plants convert light energy from the electromagnetic field into chemical energy through photosynthesis. Within plant cells are light harvesting complexes, commonly referred to as 'antennas for light'. When photons from the sun make contact with these antennas, they absorb light in the form of electron excitation. They then transfer the energy from the light to chlorophyll molecules in the reaction center, initiating a biochemical process that converts glucose into a form of energy that the plant can use to grow: ATP. This process is incredibly efficient and depends

upon fast energy transfer and excited state dynamics. This is founded in quantum coherence or superposition of excited states of multiple chromophores within the light-harvesting complex. This coherence enables photons absorbed in one chromophore to incite a collective excited state throughout those in the entire complex.[65,66] Excitement to one is excitement to the whole, like flipping a switch to light an entire city.

Bearing in mind the above examples, it is clear quantum mechanics plays a role in biology in general. The question is, what part does it play in cognition and human consciousness?

Chapter 6: Quantum Computing and Quantum Cognition

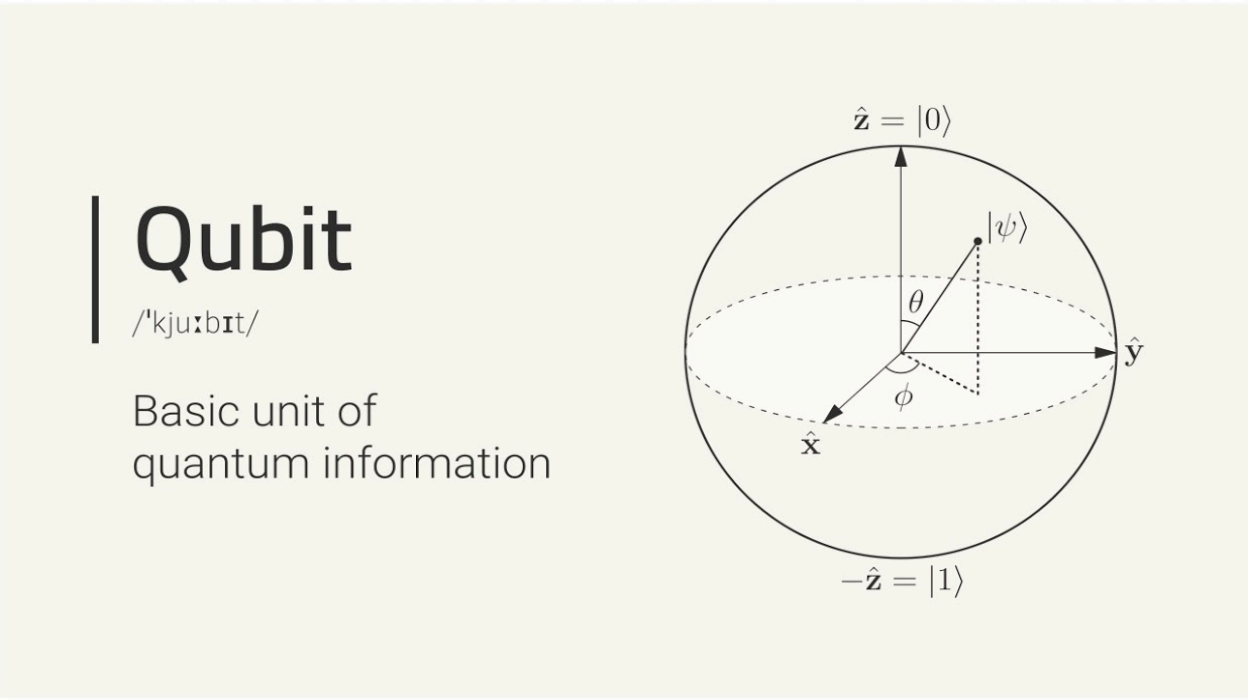
While the 'warm and wet' environment of the neurological system or human brain was previously regarded as an impossible location for quantum phenomena, quantum effects in the brain have now been brought to light, opening the gates to further exploration of quantum mechanics in consciousness and cognition. In recent years, it has been demonstrated that quantum processes including coherence and tunneling do, in fact, take place in the brain and mediate its proposed function as a quantum computer.[67] What is a quantum computer? While classical computing (what your phone, tablet, and computer use) is founded upon binary bits, quantum computing is based upon quantum bits, or qubits. Binary computers utilize two discrete digits, 0 and 1, while qubits enable much greater possibilities of computational power via quantum superposition of these 1 and 0 states.

Computers use microprocessors to express information in terms of a string of numbers. While we as humans use a base ten number system, primarily because we have ten fingers, classical computers only have two perceivable scenarios for their electrical impulses: "off" and "on". Therefore, computers use a base two number system, or a series of 1's and 0's to transmit and store information. This is called binary code. While there are multiple ways to convert binary code to numbers of more digits, perhaps the simplest is as follows: first take each number to the power of its position in order, from right to left, then add all of those calculated digits together. For example, in order to read 01011, this would be $(0 \times 2^0) + (1 \times 2^1) + (0 \times 2^2) + (1 \times 2^3) + (1 \times 2^4) = 0 + 2 + 0 + 8 + 16 = 26$. Through this method, computers can perform a wide variety of calculations and functions using only two digits.[68] Within the microprocessor, the more components

there are, the more powerful the computer. Since computers were first invented, the goal has been to create microprocessors with tinier and tinier components to create higher processing power within a smaller area. While this has allowed us to transition from the first computer the size of a room to the iPhones we carry now, engineers will eventually reach a limit on how small the components can be-- when they have the dimensions of a single atom. The next step in advancing processing power will be through the use of qubits.

The 'qubit' is the foundational unit of quantum information and exists as another two-state system, described by particle spin, which is a characteristic of angular momentum. A qubit can take the form of a photon, atomic nucleus, or electron. Electrons, for example, have two possible spin states: spin-up or spin-down. These states are essentially created by the magnetic fields of the electrons. Each electron can be thought of as containing a bar magnet. When placed in a larger magnetic field, if the bar magnet aligns with that field, it will take the lower energy state of spin-down (0). If enough energy is applied, it aligns opposite to the field and will be spin-up (1).

Superposition of the up and down states enables the electron to spin in both states at the same time-- much like a binary bit existing as both a 0 and 1 simultaneously, rather than as one of two discrete digits. It is through this spin that quantum entanglement and quantum coherence can take place. In contrast to binary bits, there exists an uncertainty of the states of the qubits. There is a probability of each state-- spin-up, spin-down, or both-- being expressed, and this ambivalence is only resolved with algorithmic observation of the electron. Because of this uncertainty, quantum bits can be used to process exponentially greater amounts of information than binary bits.[69]



If a qubit is represented as a sphere, the radius forms angles which determine the probability of observing a 1 or 0 state.

Quantum computers are in the early stages of existence. They utilize entangled qubits to harness the energy and information from these superimposed states, dramatically increasing computational and simulation ability. Google, IBM, and Microsoft all have quantum computers in development. These computers can perform complex calculations in just a few hours that would be impossible for a standard computer. On October 23, 2019, Google published in *Nature* that its Sycamore quantum computer could perform a calculation in 200 seconds that would take a standard computer 10,000 years to complete. It is predicted that we will be able to have quantum computers in our own homes as early as 2050.[70]

As quantum computing races toward the future, researchers are working on understanding the brain as a quantum computer. There are several theories that depict consciousness as a parallel of quantum computation. Scientists across the world are working to find exactly where the "spin", neural qubits, or quantum coherence is housed in the body so that we may better understand our conscious experience of reality. The most prominent theory has been developed by Sir Roger Penrose and Stuart Hameroff, MD and was proposed in 1994. It is called the orchestrated objective reduction (Orch OR) model of consciousness, which involves quantum computations through entangled microtubules in the brain. With Orch OR, Penrose and Hameroff propose that microtubules in the cytoskeleton of the neuron are the site of coherence or the marching of the band playing the symphony that is consciousness. These microtubules are protein polymers made of tubulin. They look like microscopic straws or tree trunks and connect to other microtubules by microtubule associated proteins (MAPs). These MAPs appear as branches reaching out, connecting tree trunks to form the cytoskeleton of the neurons. They are thought to allow communication within the cell. Penrose and Hameroff propose that it is within this intricate microtubular network that the collapse of consciousness or waveforms happens and that quantum coherence (marching in unison) between tubules allows for instantaneous perception of the conscious experience. They suggest that this event is irreversible in time and creates what they call the "now" event or perception.[12,71]

The question then becomes, where is this consciousness coming from? Is it held innately within the brain and body, or outside of us altogether? As will be demonstrated in Chapter 8, we are antennas for light or the electromagnetic field. With regard to the

brain (the receiver of the signal), there are reports in the literature of humans with very little brain matter who are still fully conscious. There is a case report in *The Lancet* of a 44-year-old French man who was found to have a 75% reduction in his brain volume, yet was still functioning as a normal husband, father and working as a civil servant. He had been treated for a condition called hydrocephalus with a shunt or drain at the age of six months and again at 14 years, but had been asymptomatic since then. When he reported to his doctor that he was experiencing weakness in his left leg, an MRI revealed that most of his brain had been replaced with fluid. He had no awareness that a large portion of his brain was compressed or pushed to the periphery of his skull. Case reports such as this make it clear that a human can be conscious without a large percentage of their brain intact.[72] It would appear, then, that consciousness itself is held outside of the brain and body and that we are, in fact, antennas for light.

The bridge between the quantum or subatomic world and the macroscopic world that we perceive-- our world where only classical physics is obvious-- is blurred and hard to define. We live in a reality where someone tosses a ball and we expect it to fall into our hands. An apple falls from a tree and we expect that it will hit the ground. We do not consciously perceive the collapse of waveforms or the tunneling of electrons. We do not see quantum entanglement. And yet, science shows us that two particles once entangled can affect each other when separated across hundreds of miles and even across time. In fact, a recent study shows that those two particles don't ever even have to be in the same vicinity of each other.[73] In what is called the Copenhagen interpretation, the transition from the subatomic state to the classical state means that the collapse of the wave (the odds that you will find a particular particle in a particular state) is random.

It should be noted that there is an alternative to this viewpoint, called the Everett interpretation, which suggests that these events are not only not random, but that the waves do not collapse at all. The Everett interpretation states that there is an infinite number of possibilities which occur in an infinite number of universes in which any outcome is possible.[74]
While quantum computing is at the precipice of being available to the technology industry today, it appears as though it made itself available to biology billions of years ago. This would imply that we are creating quantum computers in the image of man or woman, or at least of biology. Matthew Fisher, PhD is leading another theory on the forefront of the science of consciousness at the University of California, Santa Barbara. He studies quantum cognition in the human brain and its relation to quantum computers. He began with the foundation Penrose and Hameroff had laid with their Orch OR theory of microtubules. As previously mentioned, the body was theorized to be too hot to perform quantum mechanics. However, in quantum computing, the goal is to isolate the qubits, so they don't thermalize with the environment. Fisher began pondering quantum spin in consciousness when a relative of his, who had bipolar disorder, responded well to treatment with lithium. He hypothesized that the electron spin of lithium itself was responsible for changes in her cognition and set out to experiment with this idea. Fisher has suggested that consciousness could be mediated by quantum entanglement and coherence of the spin states of different molecules throughout the brain. These nuclear spins are correlated with the magnetic fields of protons and neutrons that compose it, generating a magnetic dipole moment.[67,75]

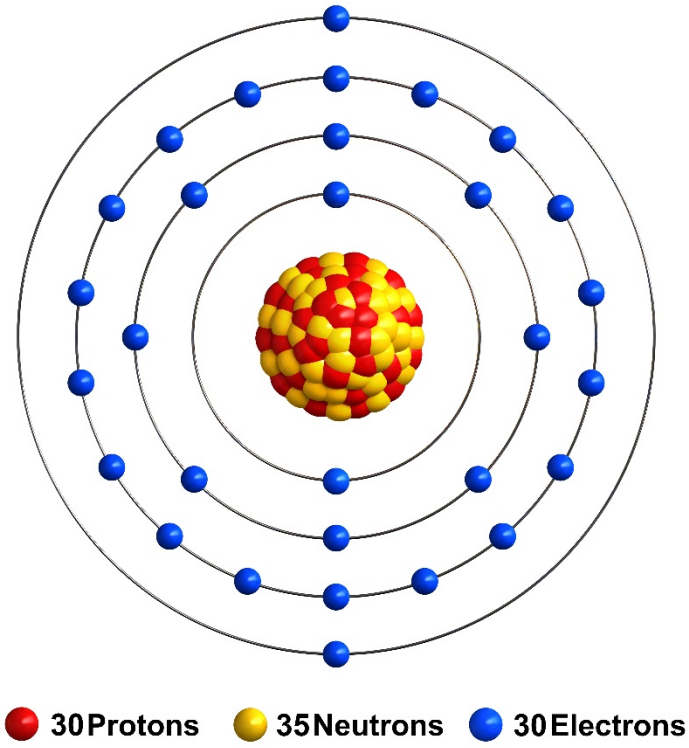
In other words, atomic nuclei, which consist of protons and neutrons, have distinct 'spins'. The term 'spin' is a misnomer-- the subatomic particles are not actually rotating on their axes. Spin is

instead an intrinsic property of the particle, as is mass, determined by the quarks that compose it. This spin produces a magnetic field which dictates the direction of the magnetic moment and therefore the direction of the spin. For instance, spin-up means that the magnetic moment is pointing up, and spin-down means that the magnetic moment is pointing down. These are the only two observed positions.[76]

To understand this, imagine holding two magnets near each other. You would be able to feel the magnetic force (the push or pull) that one exerts on the other. The whole area around the magnet where the force can be felt is called the magnetic field. This is similar to what's going on at a subatomic and atomic level-- the nuclear spins of the atoms are creating tiny magnetic fields that affect all other charged particles in their vicinity. The spin of every atomic nucleus is determined by magnetic dipoles created by its protons and neutrons.

Protons and neutrons tend to form pairs-- protons with protons and neutrons with neutrons-- in which their spins cancel out (+½ and -½). For example, if there are two protons in an atom, one will have a +½ spin and the other will have a -½ spin. This results in a nuclear spin of zero (and no magnetic moment). This means that atoms with even numbers of both protons and neutrons have a spin of zero. In those with an odd number of protons, neutrons, or both, the nuclear spin will be a half-integer (0, ½, 1, 3/2, etc.).[77] These spins can become quantum entangled, with the nuclear spin of the atoms in one molecule dictating that in another. The number of protons in an atom is determined by its atomic number, which is how the periodic table of elements is organized. The number of neutrons it has is calculated by subtracting the atomic mass from the atomic number. For example, zinc has an atomic number of 30, meaning

it has 30 protons, and it has an atomic mass of approximately 65, therefore it has 35 neutrons. The nuclear spin becomes 5/2. The image below provides a visualization of the arrangement of the electrons in zinc.



The zinc atom.

According to Fisher, there are only two atoms that could function as biological qubits: phosphorus and hydrogen. Each of these atoms have a spin of ½. Anything larger than ½ would be sensitive to electric field gradients, which are strong in water. On the other hand, atoms with a nuclear spin of ½ are sensitive only to magnetic fields, making them candidates for neural qubits. The nuclear spin of the atom can become entangled not only with

atoms in the same molecule, but with atoms in different areas of the brain.[78]

In Fisher's model, phosphorus atoms come together with calcium and oxygen to form something called Posner molecules. These are clusters of $Ca_9(PO_4)_6$ in which calcium and oxygen, neither of which have nuclear spin, form a sort of protective or insulating barrier around the phosphorus and allow its spin to persist without decohering. Because of their persisting spins, Posner molecules of distant neurons can become quantum entangled, just as qubits do. They are hypothesized to serve as the basis of quantum processing and 'qubit memory', much like a quantum computer. Posner molecules are suspected to exist in mitochondria, enabling them to quantum entangle with each other in the same cell and throughout the body. This quantum entanglement may allow for the existence and transmission of consciousness throughout the body. In essence, they would function as neural qubits.[67,75,79]

Fisher's strategy, in his words "is one of 'reverse engineering' - seeking to identify the biochemical 'substrate' and mechanisms hosting such putative quantum processing."[67]

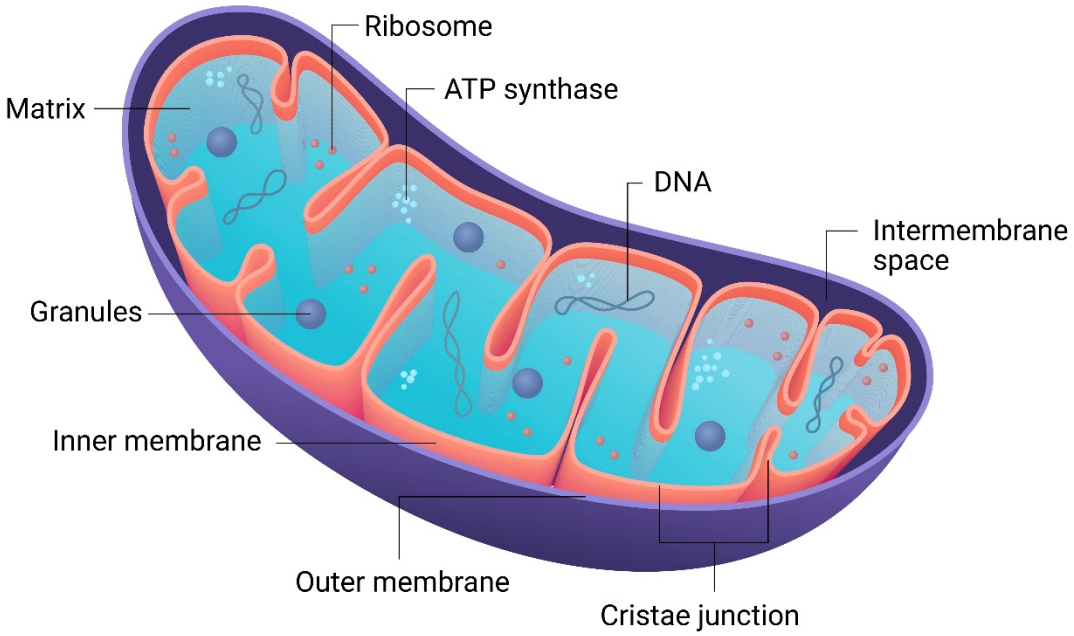
In following that line of thinking, the strategy of our approach was to reverse engineer the moment that the neural qubits, quantum code, or information becomes attached to the zygote at the moment of the zinc spark.

Chapter 7: Mitochondria, DHA, and Evolution

Mitochondria as Quantum Sensors

The mitochondria, the energy-producers of the cell, use electrons from food to create a molecule called ATP. This ATP is the body's currency of energy and information. It is required for all neurological functions, including both somatic (voluntary) and autonomic (automatic), or conscious and subconscious. 1.45 billion years ago, one single-celled organism engulfed another, and the bacteria that was "eaten" became the energy producer for the other cell.[13] As natural selection took its course, thus commenced multicellular (eukaryotic) life forms. This was the common ancestor for all complex life.[80] The DNA of both cells redistributed, allowing for a 200,000-fold increase in the number of genes expressed.[80] The innate source of energy or ATP production also allowed for intelligence and consciousness to develop. Mitochondria can produce seemingly unlimited amounts of energy, which allows for expansive amounts of information to be stored.[81] This information can take the form of memory, enabling perception of time. Memory has allowed creatures to evolve with higher orders of consciousness, sentience, or interaction with the environment as described earlier.

MITOCHONDRIA



Mitochondria. The quantum sensors for the environment.

Mitochondria serve as sensors for the environment, communicating the energetic needs of the cell with the nucleus to influence DNA expression.[82] Through release of calcium and activation of several pathways (including mTOR and AMPK), they can transmit a signal of stress response to alter expression of genes in the nucleus that protect the mitochondria, including transcription factor and tumor suppressor p53. These signals can also trigger metabolic reprogramming of the cell, protecting against damage and cancer. Stimulated by mitochondria, the

AMPK pathway promotes autophagy-- a process which cleans up damaged cellular components to restore health in the cell, like vacuuming up broken or unneeded parts.[83] Furthermore, mitochondrial metabolites (smaller molecules that were previously considered solely as intermediates for energy production, including NADH and acetyl coA) can also dictate other functions in the cell, including protein modification and chromatin function.[84] Notably, mitochondria also contain calcium and can dictate its intracellular flux. Calcium is a key signaling molecule in many cellular processes, including apoptosis (cell death) and ATP production.[85] According to environmental effects, mitochondria can create epigenetic changes to the nuclear DNA, resulting in altered DNA methylation patterns and therefore altered expression without changing the genetic code itself.[86] As described in Chapter 2, epigenetic changes can affect health and aging.

While mitochondria can control the nucleus, they also mediate the transfer of information between the cell and the extracellular environment. This includes the ability to detect invading bacteria and viruses and trigger an inflammatory immune response that leads to inflammation and controls infection through the release of damage-associated molecular patterns (DAMPs), molecules similar to those found in bacteria.[87] While there are many mechanisms of immune response in the human body, this specific process is unique to mitochondria which, as previously mentioned, adapted from bacteria-like prokaryotes.

Simply Stated

In summary, while mitochondria were previously regarded to solely be energy producers of the cell, it has recently come to light that they've also been serving the role of instructor all along,

giving orders to the nucleus and other organelles in the cell to control biological function. They can sense what is going on in the environment around them and alert the nucleus to produce more protector molecules, clean up the cell, or modify proteins. Mitochondria mediate communication between the cell and its environment, including light, as will later be discussed.

As organisms evolved with more and more cells and complex organ systems, different tissue types developed with varying densities of mitochondria, depending on their energy requirements. Of the somatic (non-sex) cells, those in the brain contain the highest amount of mitochondria per cell. This is because the brain uses 20% of the body's energy daily, which goes toward neurotransmitter production, learning and memory, emotions, and dictating function throughout the body. The human brain produces and utilizes roughly 5.7 kg (12.6 lb) of ATP per day, which is the equivalent of the use of 56 g of glucose per day if one is assuming an ATP:glucose ratio of 36:1.[88] The heart contains the second highest density or number of mitochondria per cell, followed by the immune system and musculoskeletal system. Not only have mitochondria allowed us the ability to produce ATP, but they have allowed us the ability to process and store information as they are quantum sensors for the environment. As explained above, they engage in a bidirectional information exchange with the nucleus of the cell where the majority of the DNA is housed to regulate the epigenetics of health and disease.

This brings us back to the suggestion of ketosis in the prelude. Putting your body into a state of ketosis by eating a high fat, low carbohydrate diet leads to increased ATP production by optimizing mitochondrial function. Ketosis induces a low level of stress, which optimizes the function of mitochondria and

therefore their efficiency in making ATP.[81,89] This ATP is then used for neurotransmitter turnover, improving cognitive function.

The ability to interact with the environment has allowed us to evolve from single-celled, flagellated organisms responding to objects in their environment to organisms with the ability to search for food, to where we are in current human evolution-- on the cusp of global civilization and as stated earlier, with the potential to become a Type 1 Civilization that commands the Earth and all of its resources. It appears, then, that we are like a small child peering over the edge of a tall wall and what lies in the distance has the amazing appearance of the milky way on a beautiful night. It is as if we had never before seen the stars in the night sky. As nature has shown us throughout history and at all levels, it is the organisms that work together that succeed in biology. In a pack of wolves or an ant hill, each individual has its role, but when they work together their success is magnified. In order to evolve as such, we have developed the ability to store memory, which is dependent upon our brain's ability to perceive time, dependent upon the quantum evolution of DHA in the brain. The next step in human evolution, one could then argue, would perhaps be a better perception of the environment or the simulation, as in the women with tetrachromacy, combined with an improved ability or desire to work together for the benefit of the community on a larger scale. These appear to be the patterns that nature has laid out for us.

DHA and Visual Perception

"But small is the gate and narrow the road that leads to life, and only a few find it."
Matthew 7:14

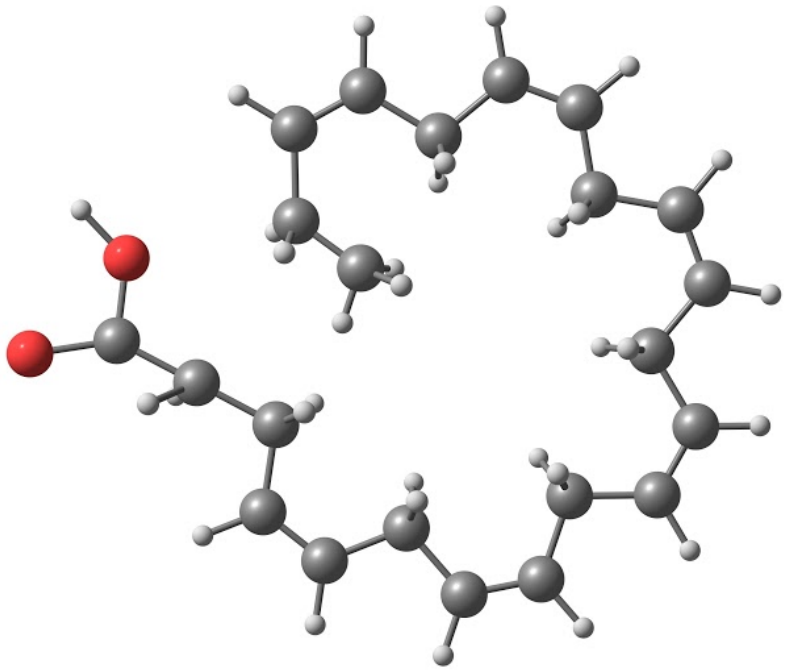
The eye is the gateway to the soul.

Once we understand ATP and the mitochondrial production of it, this leads to a subsequent step in evolutionary development: the origin of vision and the nervous system. One of the key constituents of signaling membranes in the eyes and brain is docosahexaenoic acid (DHA), a long-chain, omega-3 fatty acid that is found in fatty fish and other seafood. DHA makes up the core of photoreceptors, which convert energy from photons or waves of light from the electromagnetic field into electricity that can be transmitted as impulses through the nerves.[3] Some call this the neuronal spark. It is the conversion of energy from light to electricity that stimulated the evolution of the brain and nervous system 600 million years ago, leading ultimately to the evolution of fish, amphibians, reptiles, birds, mammals, and eventually humans.[90] Because of its critical role in neural cell signaling, the superabundance of DHA in the brain allowed for evolution of complex thought and self-awareness-- in other words, consciousness. Over the past 600 million years, DHA has been evolutionarily conserved as a primary compound of both photoreceptor synapses and neuronal signaling membranes. This is one of the few molecules that retained its function through an expansive amount of time, so efficient at its job that it was never replaced. There is no escaping it. This extreme conservation demonstrates that DHA plays a critical role in vision and brain

development, supporting the notion that the visual and neural function evolved from the ocean.[3]

DHA modulates expression of several hundred genes in the central nervous system.[91] This includes those that regulate hormone release by the master hormone gland in the brain, called the hypothalamus, and circadian biology controlled by the brain's pacemaker, called the suprachiasmatic nucleus (SCN).[92] DHA is located in highest concentrations in the retina and SCN. There is a mechanism proposed by Michael Crawford, PhD where photoreceptor membranes are responsible for the electrical current in vision.

The membrane of the photoreceptor within the retina contains proteins called opsins, which are associated with smaller chromophores called retinal. Greater than 50% of the fat molecules within this membrane are DHA. The chemistry of this molecule is very unique. It is composed of six carbon-carbon double bonds (CH=CH), three of which exist in the same plane. The other three bonds can exist in one of two positions: two of the bonds above the plane with one below, or vice versa.[3,93] To put it simply, there are two different potential energy states that the molecule can exist in: one that is polarized and one that is not. When photons (light) enter the molecule, they cause it to "flip" and become polarized, much like the flipping of a light switch. When the photon or light from the eye is no longer exciting the molecule, it flips back. The length of time that it takes for the molecule to flip (or for the lights to turn on and off) is correlated with visual memory. It is through this mechanism that the conjugated (alternating) double bonds are able to store energy or information from the ultraviolet to visible range of the electromagnetic field.[3]



The molecular structure of a DHA molecule. The gray spheres represent carbon, red spheres represent oxygen, and white spheres represent hydrogen.

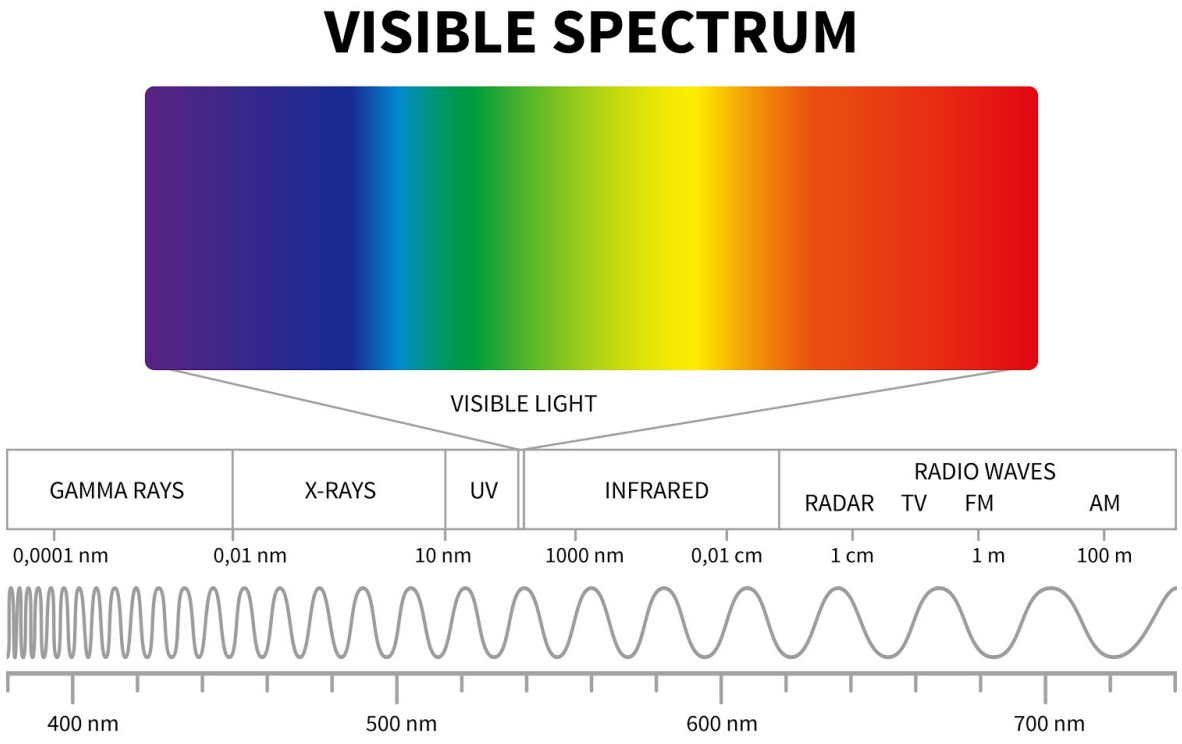
When examining the DHA molecule as a "copper wire" for electron transfer in the retina, the presence of methylene groups ($-CH_2$) appears as a problem in classical physics, because these molecules would block the current from passing from double bond to double bond. However, from a quantum physics perspective, DHA has energy states that imply its participation in coherence and tunneling. Crawford hypothesizes that the pi electrons in DHA engage in quantum tunneling, explaining the transport of electrons across the molecule despite the apparent methylene barrier. Quantum tunneling and cohesion could create the precise and quantised energy release that results in clear perception and three-dimensional vision necessary for high

function.[3,93] This would mean that we are quantum entangled with light or the electromagnetic field.

Chapter 8: The Physiological Effects of Sunlight

"My brain is only a receiver, in the Universe there is a core from which we obtain knowledge, strength and inspiration. I have not penetrated into the secrets of this core, but I know that it exists."
- Nikola Tesla

The human body has evolved as an antenna for light or the electromagnetic field. Both the eyes and skin have been demonstrated to interact with the electromagnetic field, including infrared (IR), ultraviolet (UV), and visible spectrum (VIS) wavelengths. VIS light constitutes 0.0035% of the total field.[44]



The electromagnetic spectrum. The expanded portion represents the 0.0035% that we perceive with the human eye.

As previously described, when light enters the eye and passes through the lens and vitreous, hitting the retina, it causes polarization of DHA in photoreceptors resulting in "flipping" of the molecule. Photon energy is transmitted through the optic nerve and optic chiasm to generate the neural spark that regulates the SCN in the hypothalamus via input to the retinohypothalamic tract. This controls circadian rhythm. It is through this mechanism that photons trigger electrochemical signals that are transmitted along retinal axon projections to the SCN of the hypothalamus.[94] The SCN is the core pacemaker in the brain, akin to a circadian clock, regulating physiological functions including but not limited to hormone release,[4] metabolism,[94] and mitochondrial function.[2] This pacemaker can be thought of like the pacemaker of the heart, however it is on a 24-hour cycle rather than beat to beat. Our bodies are meant to be intimately attuned to the cycling of the sun, and disconnection from these 24-hour signals of light and dark dramatically increases incidence of disease.

As previously described, mitochondria operate as sensors of the external environment-- part of that environment being the electromagnetic field, or light. They can be thought of as a sixth sense in nearly every cell of our body, specifically for the input of light. The SCN synchronizes mitochondria in peripheral tissues using a mechanism that consists of a transcriptional-translational feedback loop (TTFL), which modulates a molecular clock mechanism via clock-controlled genes.[95] Night and day cycles have been demonstrated to regulate mitochondrial biogenesis and functions including fission and fusion processes, reactive oxygen species production, and cellular respiration. While the molecular clock is conserved in all tissues types, its downstream effects are tissue specific. In experiments conducted in the SCN of mice, there was an upregulation of several genes that code for components of the mitochondrial electron transport chain toward

the end of the light phase, matching higher energy consumption of the brain during daylight hours.[2] The peripheral clock mechanisms have also been demonstrated to regulate physiological function of the liver and skeletal muscle, dictating transcription of proteins involved in glucose regulation. Additionally, as with autophagy or cell cleaning, mitophagy (the degradation of mitochondria) has been demonstrated to fluctuate throughout the day in a day/night dependent manner.[96] Because light regulates mitochondrial ATP production, which is necessary for most physiological functions, this is one of the mechanisms mediating our connection to the electromagnetic field.

Simply Stated

In summary, it could be said that the suprachiasmatic nucleus functions like a solar powered grandfather clock sending signals to coordinate a tiny alarm clock in front of every mitochondria within us. During daylight hours, it sends signals to the mitochondria (the mini suns or batteries within the cells) to create the energy for the day, and at night it gives instructions that it is time to quiet down and perform the cleaning functions, autophagy, of the cell like, running the dishwasher when all of the busywork is done.

Emerging literature demonstrates that sunlight also regulates physiological function through the skin, in ways additional to the well-described process of vitamin D synthesis. As our largest protective organ, the skin serves as a communicator between the outside environment and our nervous, endocrine, and immune systems. Ultraviolet light (wavelengths 100-400 nm) is capable of inciting signal transduction via cellular chromophores, including aromatic amino acids, certain molecules containing purines or pyrimidines, and others. It is important to note that the skin is a

complex neuroendocrine system and produces many constituents of the neuroimmune system which have both local and central effects, including but not limited to acetylcholine, serotonin, cannabinoids, nitric oxide (NO), and neuropeptides.[97,98] Upon contact with the skin, ultraviolet radiation (UVR), can regulate homeostasis throughout the body through stimulation of all elements of the central hypothalamic-pituitary-adrenal (HPA) axis, including glucosteroidogenesis, upregulation of the *CYP11A1* and *CYP11B1* genes, release of ACTH, MSH, corticotropin releasing hormone (CRH)/urocortin, proopiomelanocortin (POMC), and more.[99-101] While it serves many neuroendocrine functions, POMC is notably involved in the regulation of dopamine, known as the reward or pleasure neurotransmitter.

The neuroendocrine effects of UVR are relatively rapid, with observed increases in serum levels of MSH, ACTH, and CRH within hours of skin exposure to UV. The downstream signaling effects of UVR are demonstrated by altered activity of internal organs, including the GI tract, liver, lungs, kidney, and spleen.[4] The specific effects of UVR are dependent on the wavelength of light and the chromophores that they interact with. UVA and UVB have very different effects on the body. Not only does UV light have a profound effect on the skin and in turn on homeostasis, but so does visible light (VIS), as evidenced by its increased use in treating medical conditions.[102]

As demonstrated in multiple review articles, sunlight (including UV and VIS) can modulate neural, endocrine, immune, and metabolic function through contact with the eye and skin.[4] After sensing light input and undergoing molecular changes, chromophores signal effector domains to perform light-dependent functions. In essence, these molecules 'carry' the light via electron excitation in order to have profound physiological effects on DNA expression

and organ system function. It is notable that cobalamin (otherwise known as vitamin B12) has recently been classified as a red-light chromophore, absorbing light with which it can modulate DNA expression and alter RNA-based regulatory elements.[103]

Simply Stated

In essence, this means that skin functions like a brain, and provides input to regulate the body's hormone, nervous, and immune functions. The input to this skin/ brain is the light or electromagnetic field or seven colors of the rainbow. Each wavelength of light excites or gives energy to different molecules in our body that are responsible for our health in ways that we don't even have to consciously think about-- they happen at a level below our perception. For example, serotonin allows us to feel calm and dopamine allows us to feel pleasure. It is the exposure of the eye and the skin that give these molecules their energy so that we feel good.

Different fields of medicine have also developed uses for light to heal disease. For example, UVA light in the range of 340-400 nm has been shown to treat pityriasis rosea. Red and near infrared light in the ranges of 633nm and 830nm have been used to treat pain and heal wounds. Narrow band UVB light therapy is first line treatment for mycosis fungoides (the most common form of cutaneous lymphoma).[104] Both UVA and UVB light is used to treat eczema. There is even evidence that suggests that the use of indoor tanning beds may cause addictive behavior due to increases in POMC production, creating an opioid-like response. Because tanning beds emit some of the same wavelengths as the sun, this suggests that sunlight does the same.[105]

Given human dependence upon the electromagnetic field, we will next discuss the intertwining of our physiology and subatomic particles with the Higgs field.

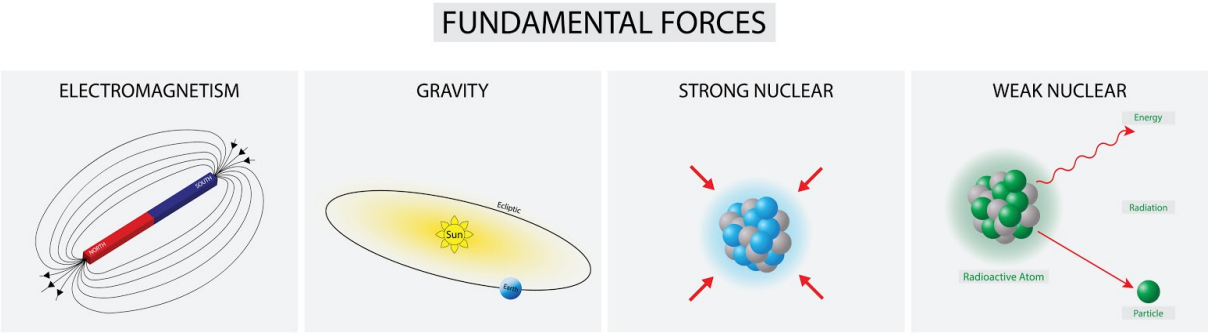
Chapter 9: Standard Particle Model

We learn in school that atoms are the basic building blocks of matter. They're made up of three subatomic particles: protons, neutrons, and electrons, which give the atom its mass. But what are the subatomic particles made of? And where do they get their mass?

The smallest, most fundamental particles in physics are classified by the Standard Model of physics. The Standard Model was developed in the 1970s and unifies three of the four known forces of nature: the strong force, weak force, and electromagnetic force (but not gravity).

The strong force is the most powerful of the four fundamental forces. This is followed by the electromagnetic force (137 times weaker), the weak force (one million times weaker), and gravity, which is the weakest force (6×10^{39} times weaker than the strong force). It is unclear why gravity is so weak compared to the other forces, as if some of it is missing or slipping away as we will explain. The strong force explains how protons and neutrons stick together to form the atomic nucleus, rather than falling apart from each other. On an even smaller level, the strong force holds quarks together to make up protons and neutrons themselves.[106]

The electromagnetic force exists between two electrically charged particles. For example, two protons (which are positively charged) repel each other, as would two electrons (negatively charged), while a proton and electron attract each other. This interaction is a result of the electromagnetic fields created by each of the particles.

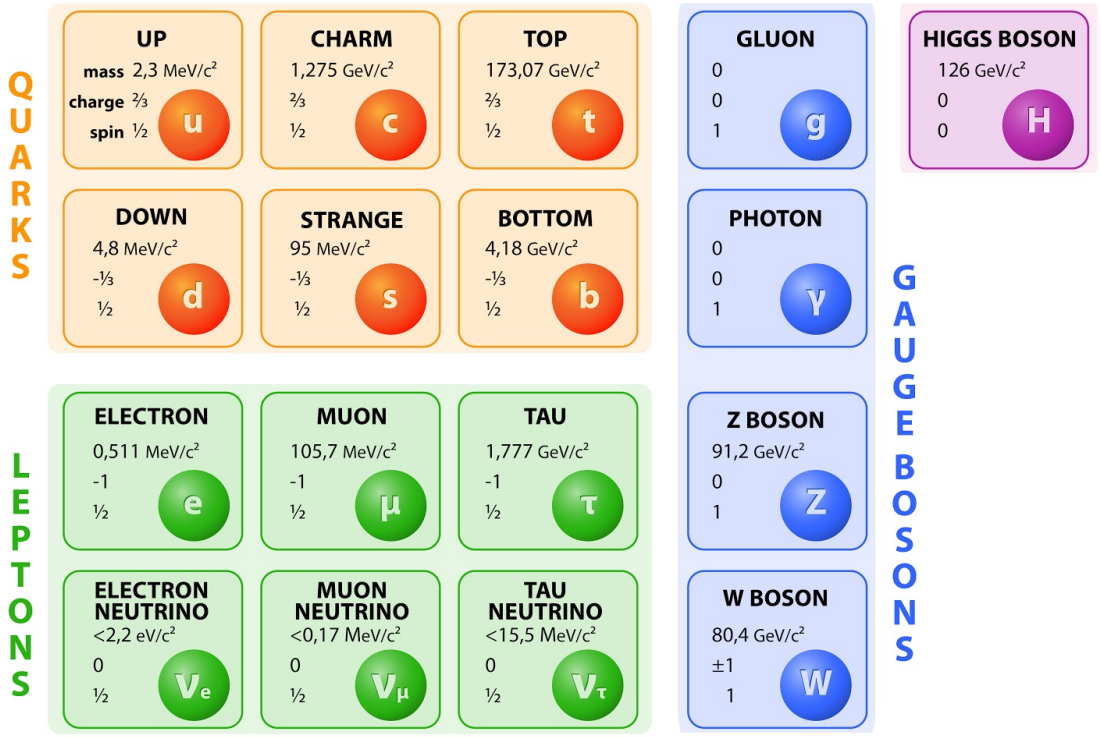


The strong force, electromagnetic force, and gravity hold things together, while the weak force is responsible for things falling apart or decaying. It is stronger than gravity, but works only at short distances. It is responsible for the radioactive decay of atoms and nuclear fusion.[106]

The question in physics is, why is gravity so much weaker than the other forces? String theory suggests that there are other dimensions than the ones we can see (three dimensions of space plus time) or observe, that gravity extends across those other dimensions, which weakens it, or at least our perception of it.

The Elementary Particles

There are two primary categories of elementary particles: bosons and fermions. Bosons are the massless force carriers or bundles of energy, while fermions are responsible for making up matter. Below is a chart categorizing the particles of the Standard Model.



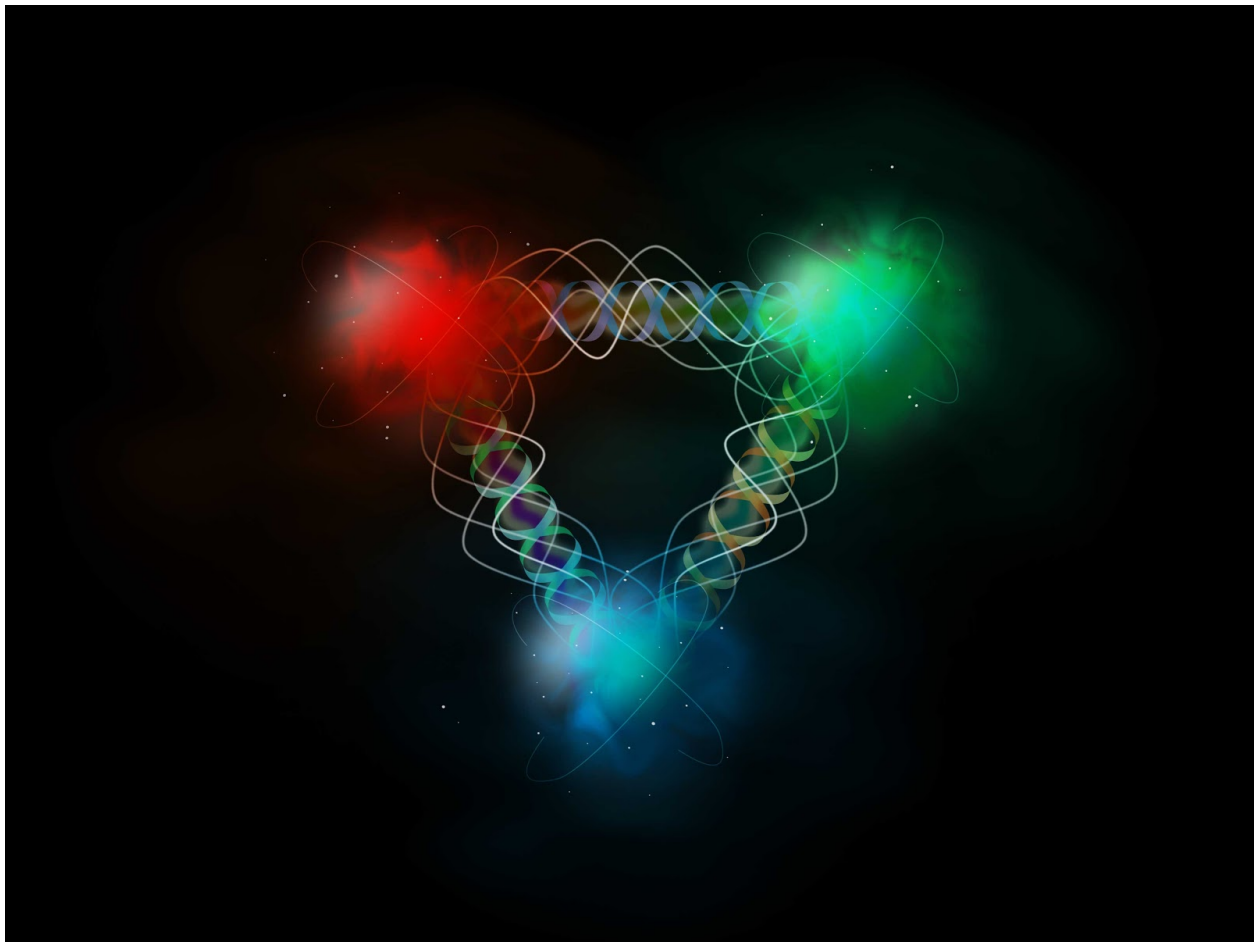
The Standard Model organizes the elementary particles. The left portion of the diagram shows the fermions (quarks and leptons), while the right portion shows the bosons.

Bosons, which are on the right side of the above table in blue and purple, act as messengers, mediating the interaction between different particles. They can take the form of photons, gluons, W and Z bosons, or Higgs bosons. Each of them is a quantization of their respective fields. For example, a photon is essentially a bundle of energy from the electromagnetic field. If the electromagnetic field were a calm sea, the photon could be likened to a peak of a wave. It is the excitation of the otherwise uniform water (the field) that forms the particle that is light. Similarly, the gluons are force carriers of the strong force and the W and Z bosons are carriers of the weak force. Gluons act as the "glue" that holds together the quarks that make up protons and neutrons.

Fermions are further divided into two categories: leptons and quarks, shown in orange and green on the left side of the table. There are six "flavors" of each.[107]

Of the leptons, there are three charged elementary particles: the electron, muon, and tau. The electron has the lowest mass of the three charged leptons, followed by the muon and then the tau. Each of these three particles are identical in spin and charge and vary only by mass. For each of the charged leptons, there are corresponding uncharged leptons called neutrinos. Neutrinos interact only via the weak force and gravity, unaffected by the strong force.

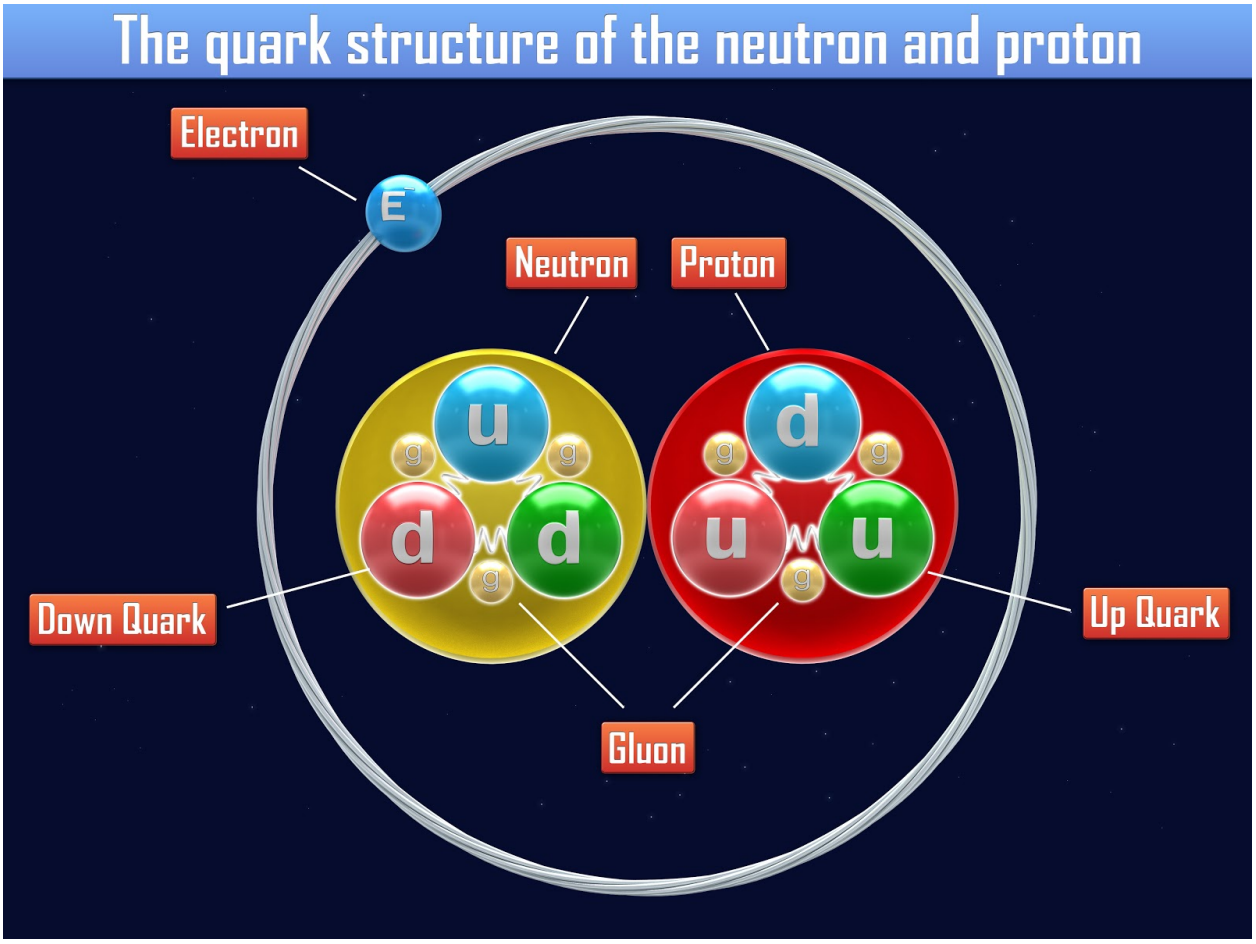
Hadrons are subatomic particles composed of two or more quarks held together by the strong force. They can be further divided into baryons and mesons. Baryons are the class of particles that include protons and neutrons. They each contain three quarks. Protons and neutrons make up all of the atoms around us and in us. Mesons are unstable subatomic particles made up of a quark and antiquark. An antiquark is defined as the antimatter counterpart of a quark and has the opposite electric charge. Mesons can be made by interactions with high energy cosmic rays or in particle accelerators and they don't stick around long. Particle accelerators are large machines that use the electromagnetic field to push charged particles toward one another at very high speeds.



An impression of the colors of quarks that make up a proton.

Quarks come in six different “flavors”, as seen in the table above. These flavors are up, down, strange, charm, bottom, and top. Quarks have electric charge, mass, color charge, and spin. They also experience all four forces (strong force, weak force, electromagnetic force, and gravitation). Additionally, quarks are labelled as having color, but not as we classically think of color. This color is the basis of the strong interaction, like electromagnetic interactions are based on electric charge. These “colors" are red, blue, green, anti-red, anti-blue, and anti-green. Quarks have color, while anti-quarks have anti-color. When the

quarks combine, for example in a proton, they are colorless. In quantum physics, there is something called the Pauli exclusion principle, and it states that two or more fermions (particles with half-integer spins) cannot occupy the same state within a system at the same time. Because of this, scientists had to go looking for different forms of quarks to meet the Pauli exclusion principle--this is how they found the color charge. The heavier quarks rapidly decay into lighter quarks or up and down quarks. The others can only be produced by high energy collisions with cosmic rays or in particle accelerators. Experiments in particle accelerators have proven the existence of all six flavors. A given proton would have all three colors of quarks in a given arrangement. For example, $u_r u_g d_b$, $u_b u_r d_g$, or $u_g u_b d_r$.[108]



These quarks make up the components of the atomic nuclei and will be important as we return to discuss the zinc spark. The nucleus of zinc contains 30 protons and 35 neutrons. Protons contain two up quarks and one down quark, for example up, up, down (uud). Neutrons are made of two down quarks and one up quark. The charge of an up quark is +⅔ and that of a down quark is -⅓. Doing the math, this explains why neutrons do not have charge and protons have a charge of +1. These quarks cannot exist on their own.

Simply Stated

Let's simplify the preceding information. Quarks "feel" the effects of the strong force, weak force, electromagnetism, and gravity. They have mass, spin, color, and electric charge. They come in six flavors-- like six flavors of ice cream. Let's assume you go to the ice cream parlor on a hot summer day and you have six options for flavors. The two most common flavors, vanilla and chocolate, are the up and down quarks, respectively. The other quark variants, let's say rocky road, pistachio, butter pecan, and cookie dough melt so fast that they don't stick around long enough to purchase. These last four flavors can only be made by aggressively mixing the added ingredients (like cookies or pecans) with the ice cream, like aggressively colliding particles in a particle collider. On top of your ice cream, you have the choice of a sweet topping that comes in the colors red, blue, and green, or sugar-free versions anti-red, anti-blue, and anti-green. The number of protons inside of each atom determines the atomic number on the periodic table.

For the sake of this discussion, we are only interested in the atomic number of zinc, which is 30. This means that zinc has 30

protons, and it has 35 neutrons, all tightly packed together in its nucleus. Inside of each of the 30 protons there is a triple scoop cone with two vanilla (up) and a chocolate (down). In each neutron, there is a triple scoop cone with one vanilla (up) scoop and two chocolate (down). On each of these scoops is a red, green, and blue topping dripping down the sides. Now imagine that these three ice cream colors are held together with molasses. The molasses would be the sticky substance or the glue (gluons) that holds the colored toppings together. The amount of code, qubits, or information that these zinc atoms could hold is huge, and if we were talking about 20 billion of them, that would be spectacular. That would be enough to hold the code of a human consciousness.

The Higgs Field

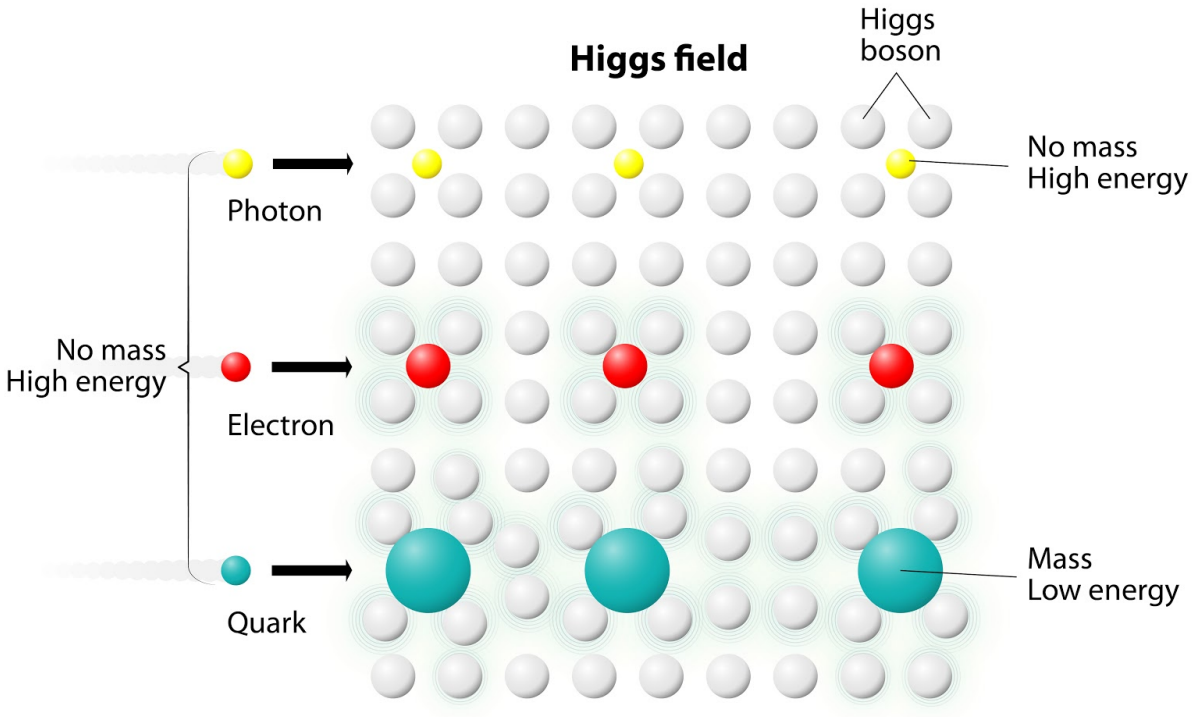
The mass of the baryons is generated partially by the intrinsic mass of the quarks, but largely by the kinetic (motion) and binding energy of the quarks being confined in the proton or neutron. This confinement is mediated by the strong force, through gluons. And where do the quarks get *their* mass?

This is where the Higgs field comes in. In 1964, Francois Englert and Peter W. Higgs independently proposed a mechanism for how elementary particles acquire mass. According to the first law of thermodynamics, energy and information can neither be created nor destroyed. It can only be transferred or transformed. The Higgs mechanism, which describes the generation of mass for gauge bosons, obeys this law. The Higgs field is a quantum field of energy that permeates every area of space. Scientists hypothesized that every particle (including those that make up you) is constantly interacting with the Higgs field.[109] Quantum field theory predicts that all fields have an associated particle and

fundamental particles are formed by excitations (vibrations) of their own fields. These fields exist everywhere and fill the entire universe. For example, a photon is an excitation of the electromagnetic field. Similarly, a Higgs boson is an excitation of the Higgs field. You can again think of these like a peak of a wave in the ocean.

To visualize the Higgs field, think of a football field. Now, picture that football field in three dimensions, like a massive 100-yard-long fish tank. Imagine living in that tank, with water filling every space around you. Every move you make would be countered by water. The resistance that you would feel is analogous to the slowing down of the gauge boson by the Higgs field. If the field did not exist, electrons would travel near the speed of light. However, the field traps them, slowing them down. This is what we perceive as the mass of a particle. It has been discovered that this field, like the water in the giant fish tank, is everywhere. It fills every bit of the universe. What we perceive with our limited senses as empty space is in fact not empty, but occupied by a field of energy.

THE HIGGS MECHANISM

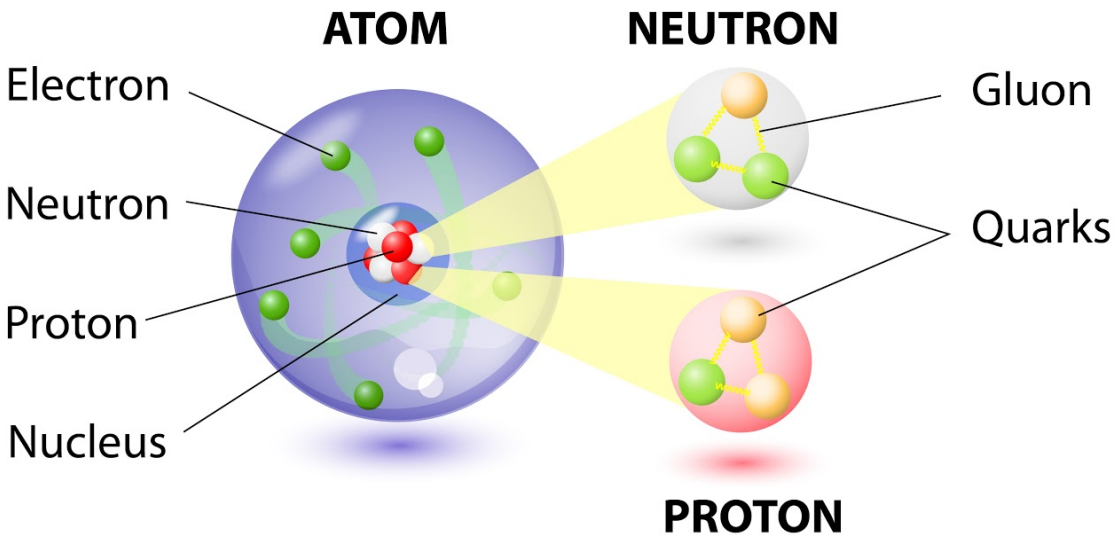


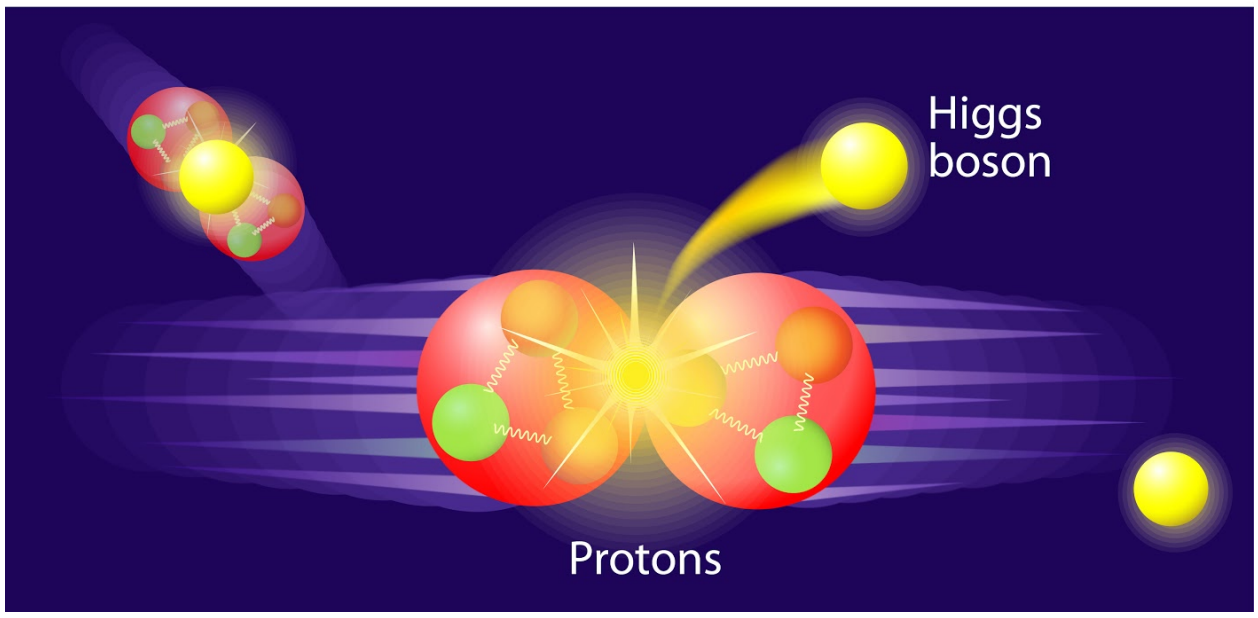
A visual depiction of photons passing through the Higgs field and maintaining their energy, while the quarks that make up our matter are slowed down, losing their energy but acquiring mass.

The Higgs field was considered theoretical from its proposal in 1964 until July 4, 2012, when researchers at CERN (one of the leading centers for scientific research on the study of particle physics located in Switzerland) announced that they had experimentally confirmed the existence of the Higgs boson. CERN is home to one of the largest and most powerful particle accelerators in the world, the Large Hadron Collider (LHC). The LHC is a 27-kilometer-long tunnel that accelerates two protons toward each other at velocities near the speed of light. This is a cryogenic tunnel that maintains a temperature of -271.3 degrees Celsius, which is colder than outer space. They use 9,300

magnets to guide charged particles, directing them toward each other in a head-on collision.[110] Originally built in 2008, the collider cost $8 billion to build, of which the United States contributed $531 million. There are 8,000 scientists from 60 countries participating in CERN's research. The intent was to discover the subatomic particles that make up our world.[111] Try to envision a giant, freezing cold toy racetrack. Imagine taking two tiny race cars and hurling them around the track at each other. The collision of the two cars would cause an explosion of pieces, and in those flying bits of toy cars new pieces, like a tiny new headlight, might pop into existence for only for a brief moment. Observers would need to have just the right sensors to detect this tiny new light from the lamp before it disappeared. In those pieces, new bits of never-before-seen energy were predicted to be revealed.

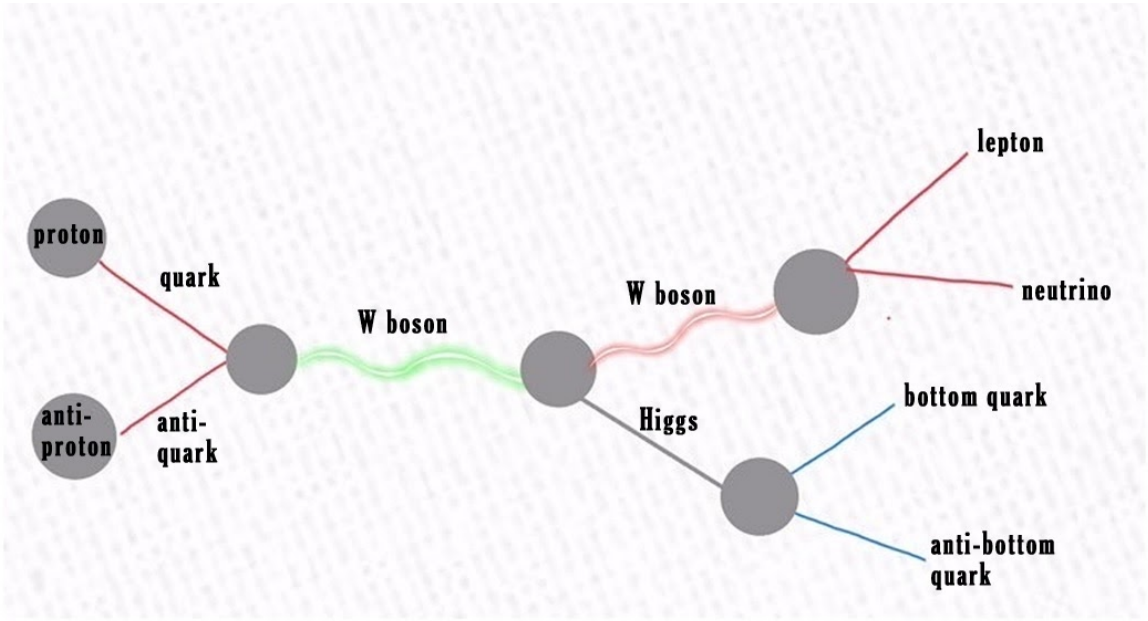
HIGGS BOSON



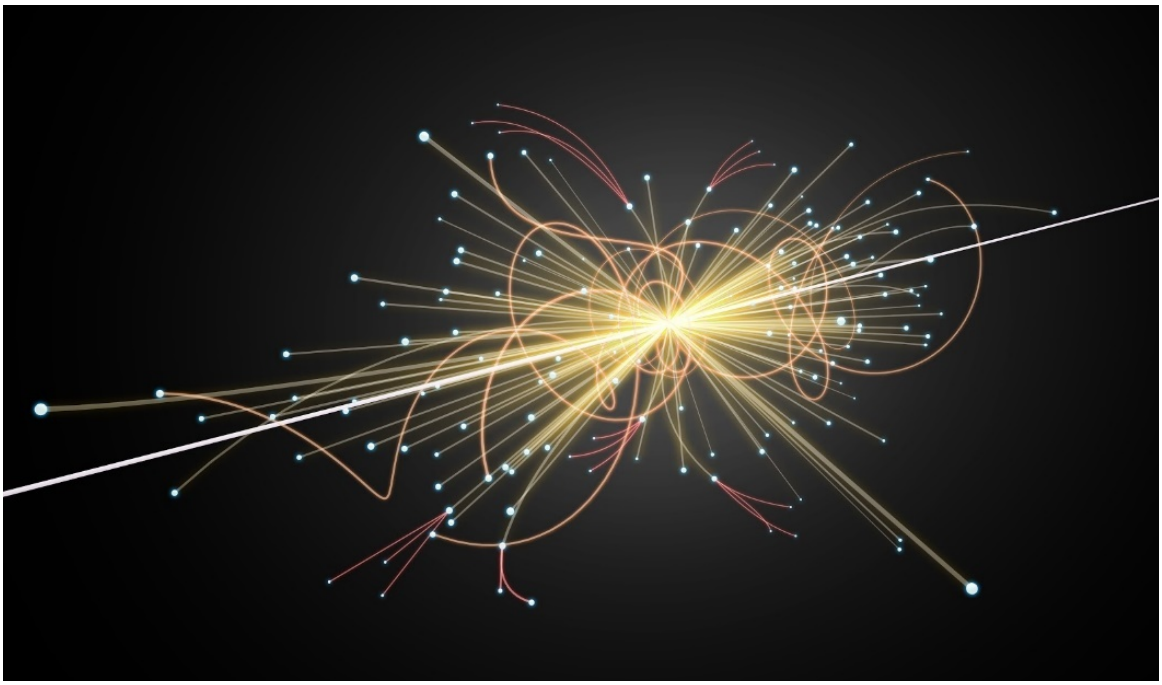


Another way to think of what researchers are doing at CERN is the opposite of what astronomers are doing in space. Astronomy is the study of celestial bodies-- planets and asteroids with

diameters that are thousands of miles across. CERN is studying the opposite, the tiniest of subatomic particles on the smallest scale, the quantum scale. As you would use a telescope to observe outer space, CERN focuses on particles too small to detect with a microscope. From CERN's inception in 2008, researchers were searching for the Higgs boson, the fundamental particle that proves the existence of the Higgs field. On July 4, 2012 they announced that they had found it. Because the Higgs boson decays so rapidly, it was the observation of its decay products (elementary particles) that confirmed its existence. Two large detectors, called CMS and ATLAS, captured the proton collision and the vector bosons it decayed into. The Higgs boson most commonly decays (58% of the time) into bottom quarks, the heaviest of the fermions or basic matter. However, observation of these is easily obscured by bottom quarks in the background. ATLAS and CMS take in massive amounts of data from all particles in their field of observation. Therefore, the existence of the Higgs boson was detected instead by the presence of vector bosons: weak vectors from the weak interaction and photons from the electromagnetic interaction, less common to be randomly observed by ATLAS and CMS. The experimental evidence of the Higgs boson has been monumental in the world of physics. Its discovery validated the Standard Model, confirming how elementary particles acquire mass.[112] **The mass that elementary particles have was once a part of the Higgs field in the form of potential energy, prior to it being manifested into matter.**



A breakdown of the decay products of the Higgs boson into a bottom quark, anti-bottom quark, lepton, and neutrino. Image courtesy of John William Hunt.



Particles colliding at the LHC.

String Theory

What's next for CERN? The next step in the quest at CERN is to look for other dimensions, as predicted by string theory and M-theory. The purpose of these theories is to unify all of the previously described forces of nature into one eloquent mathematical formula. One of the questions that needs to be solved is that of gravity. Gravity, which is based on Einstein's theory of general relativity and exists within classical physics, must be reconciled with quantum mechanics in order for a unified theory of everything to exist. Why is gravity so much weaker than the other forces? One theory suggests that it is so much weaker because it is spread across the other dimensions of string theory. As we live our lives, we perceive three spatial dimensions (up/ down, left/ right, backward/ forward) plus time-- a total of four dimensions. Scientists developed string theory in an effort to explain the additional dimensions that gravity would spread out over. String theory proposes that the standard particles previously discussed are actually tiny, vibrating strings coiled up so small that we cannot observe them. If you back up or widen the lens on these strings, they would all appear as particles that vibrate. String theory states that there are nine dimensions plus time, for a total of 10 dimensions. All in all, there are five different versions of string theory proposed. At a string theory conference at USC in 1995, a novel concept was proposed by Edward Witten, PhD, a theoretical physicist. He suggested that the five versions of string theory were actually one theory of 11 dimensional supergravity, superstring theory, or M-theory to incorporate all five types of string theory.[113] This theory would give rise to the graviton or particle associated with gravity itself (like the photon for the electromagnetic field) and would unify all four natural forces (strong force, weak force, electromagnetic force and gravity).[114] The hope is that M-theory provides the unified theory of all of

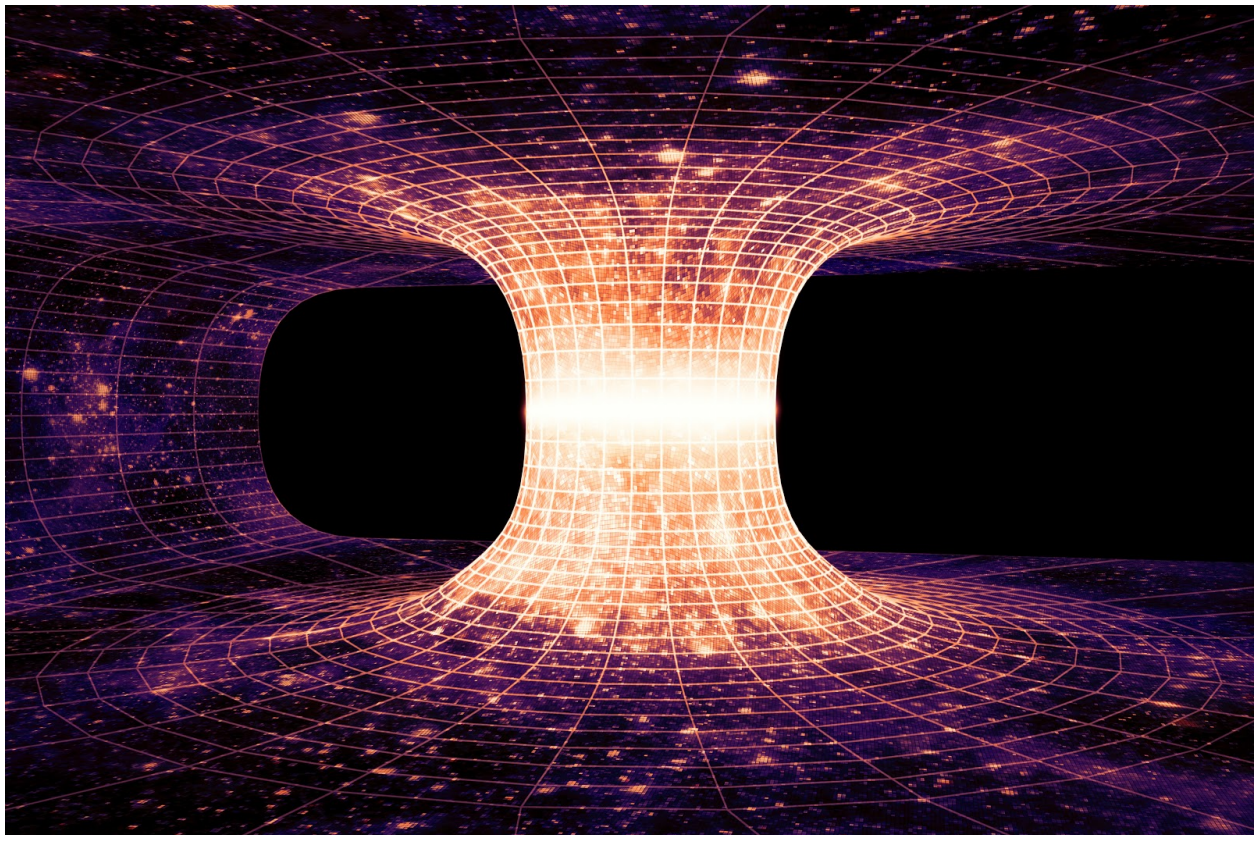
nature's forces. If other dimensions do exist, that could explain why we don't feel the full force of gravity. It would be as if it was slipping away into these unseen dimensions. If these other dimensions exist and we cannot perceive them, it is possible that they are hidden in a scale so small within tiny vibrating particles that make up our universe.

One possibility for detecting these alternate dimensions would be the production of microscopic black holes at a particle collider such as CERN. The idea of microscopic black holes was first proposed by Steven Hawking in 1971. These miniature black holes, called Schwarzschild black holes, are proposed to have a mass of one Planck. In 2010, a paper by Choptik and Pretorius demonstrated that a computer simulation of microscopic black holes could be possible at the LHC energies and may reveal alternate dimensions beyond the four dimensions that we observe.[115] CERN states that if these microscopic black holes are found they would disintegrate rapidly, in 10^{-27} seconds and would decay into standard particles. It should be noted that if these black holes are created, they are proposed to be harmless. Their gravitational pull would be so weak that they would not disturb the surrounding environment. Black holes form by gravitational collapse into spacetime singularities. Any microscopic black hole created by the LHC would quickly lose mass and energy via Hawking radiation. This Hawking radiation consists of emitted elementary particles, including photons, electrons, quarks, and gluons.[116]

It is theorized that just as the photon is the excitation of the electromagnetic field, there should be a particle called the graviton or the associated particle with gravity. If gravitons are found, they would quickly decay and "escape" to other dimensions of M-theory. The collisions at the LHC should create a

spark with particles splattering about and if a graviton slips out to another dimension it would leave an empty spot that would be noticed by CERN's detectors.

In 1935, Albert Einstein and Nathan Rosen wrote a paper on Einstein-Rosen bridges or wormholes. These wormholes are contortions of spacetime geometry as described by Einstein's gravitational equations.[117] Also in 1935, Einstein, Boris Podolsky, and Rosen wrote a paper on quantum entanglement or "spooky action at a distance."[60] At the time they did not see the two to be connected; however, in 2013, Leonard Susskind and Juan Maldacena proposed that the wormhole connects a pair of maximally entangled black holes. They created the equation ER=EPR. This explanation states that quantum entangled particles are unified through a wormhole or an Einstein-Rosen bridge, essentially tying together the two papers by Einstein from 1935. Susskind and Maldacena proposed that merging these could be key to unifying quantum mechanics and general relativity. This would suggest that spacetime itself is drawn from the tapestry of quantum entanglement. They suggest that information or spin of a particle on one side of the wormhole would be quantum entangled or affect the spin of particles on the other side of the wormhole.[118]



A rendition of two black holes connected by a wormhole or Einstein-Rosen bridge.

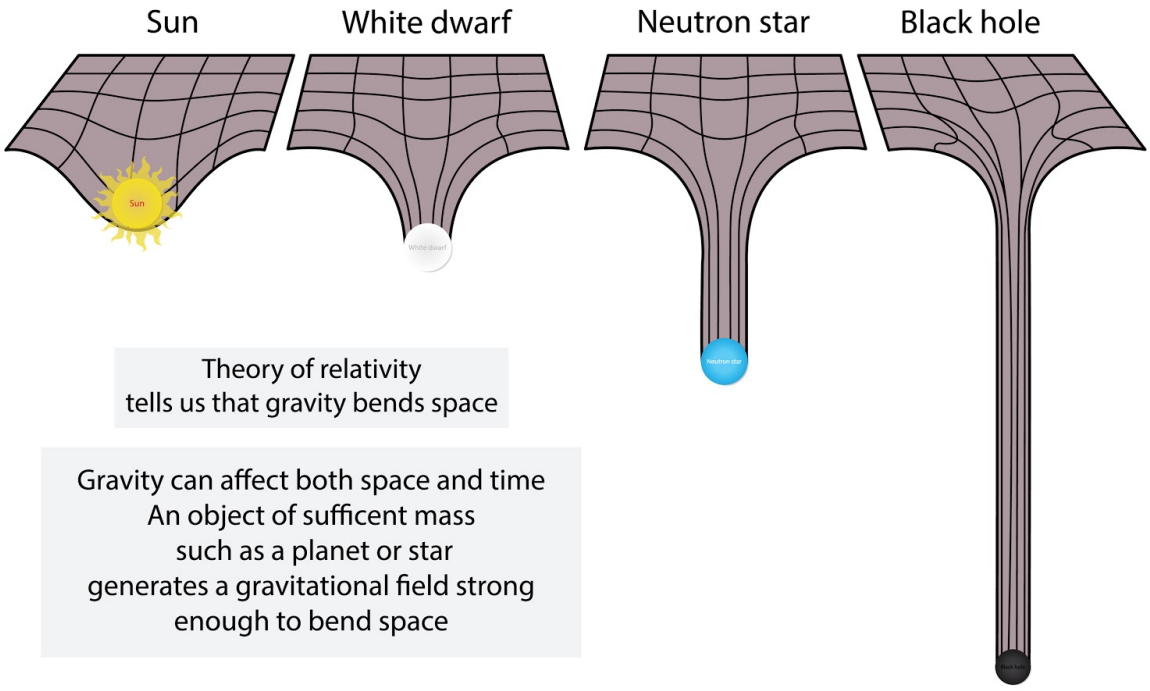
If the LHC can successfully create a microscopic black hole, this would be the experimental evidence supporting the versions of string theory, superstring theory and M-theory, or the mathematical "theory of everything" that integrates gravity with the other three fundamental forces. What we would detect would depend on the number of extra dimensions found, the mass of the microscopic black hole, the size of the dimensions and the energy at which it occurs. If found, it is thought they would disintegrate into the particles of the Standard Model after 10^{-27} seconds. This would create events that the detectors at CERN would spot, much like LIGO did on a massive scale.[119]

To quote CERN, "Microscopic black holes are thus a paradigm for convergence. At the intersection of astrophysics and particle

physics, cosmology and field theory, quantum mechanics and general relativity, they open up new fields of investigation and could constitute an invaluable pathway towards the joint study of gravitation and high-energy physics."[116] There is yet another field unified in this paradigm for convergence. The field of human biology and fertilization. Let us look back up to space for a more detailed understanding of the behavior of black holes. We will see another representation of nature repeating itself in the golden ratio or Fibonacci pattern.

Chapter 10: Black Holes

As above, so below. Now that we have an understanding of the Higgs boson and microscopic black holes, let's widen the gaze back up to the scale of the cosmos. Black holes were initially predicted by Albert Einstein's theory of general relativity, published in 1915. The theory unified his theory of special relativity and Newton's law of universal gravitation. It essentially explains gravity based on the way space can curve.[120]



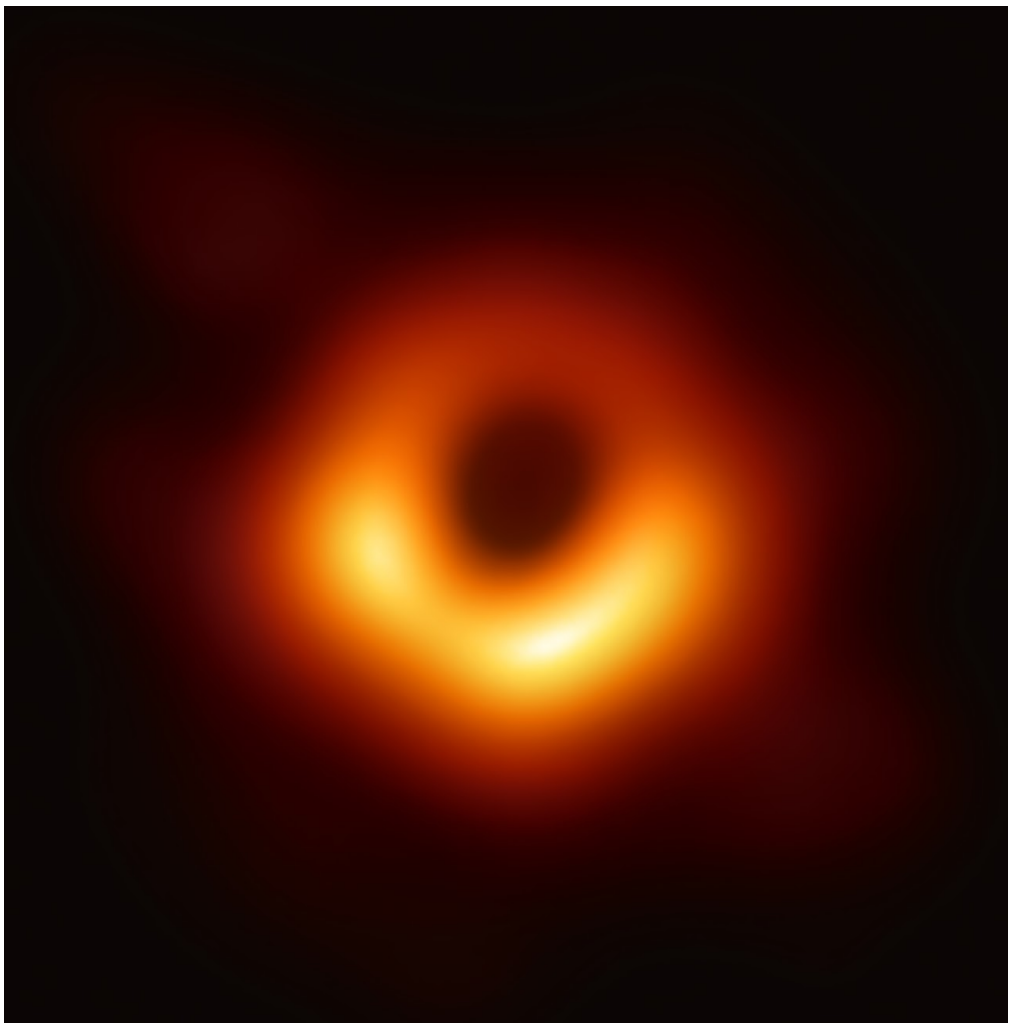
In order to understand this, we must first explain Einstein's theory of special relativity. His paper "On the Electrodynamics of Moving Bodies" published in 1905 demonstrated the relationship between space and time for objects moving in a straight line at a constant speed. Einstein's most famous equation $E=mc^2$ explains this. Energy equals mass times the speed of light squared, where

c is equal to the maximum speed of light in a vacuum. This equation implies that mass and energy are interchangeable or different forms of the same thing.[121] The theory of general relativity takes into account objects that are accelerating (not moving at a constant speed) and provides an explanation of the curvature of spacetime, experienced as gravity.[120] To visualize the curvature of spacetime, imagine a bedsheet spread out and suspended in the air by two people. Now imagine placing a bowling ball right in the middle of it. The ball would warp the sheet, creating a dip-- similar to how Earth and the sun warp the fabric of spacetime itself. If a marble were placed toward the edge of the sheet just where it starts to plunge, it would be drawn in toward the ball. This is similar to Earth's gravitational pull exerted on all surrounding objects. Relatively speaking, this gravitational force is very weak.

If the object (bowling ball) exerts a strong enough gravitational force, nothing can escape its pull— including light— and thus a black hole is formed. Spacetime itself collapses into a gravitational singularity, or a single one-dimensional point where the magnitude of gravity and density approach infinity. This is where the established laws of classical physics cease to apply. Their circumference is defined as the event horizon, or the one-way trap door of space at which nothing can escape its inward pull. According to the no-hair theorem, black holes lack characteristics other than mass, angular momentum (rotation), and electric charge. All other properties (or hair) would be sucked into the black hole, disappearing. In this example, hair is a metaphor for information.

In 2019, the first-ever photograph of a black hole was taken. Because the black hole itself is unable to be seen, what is visible is the glow of the event horizon as it sucks in all approaching

light, matter, and cosmic dust. The photographed black hole is at the heart of a galaxy approximately 53 million light years away, 6.5 billion times heavier than our sun. Photographing the black hole took over 10 years of work and efforts of the international Event Horizon Telescope (EHT) consortium which utilized radio dishes from around the world to create a telescope the size of the earth to produce the images.[122]



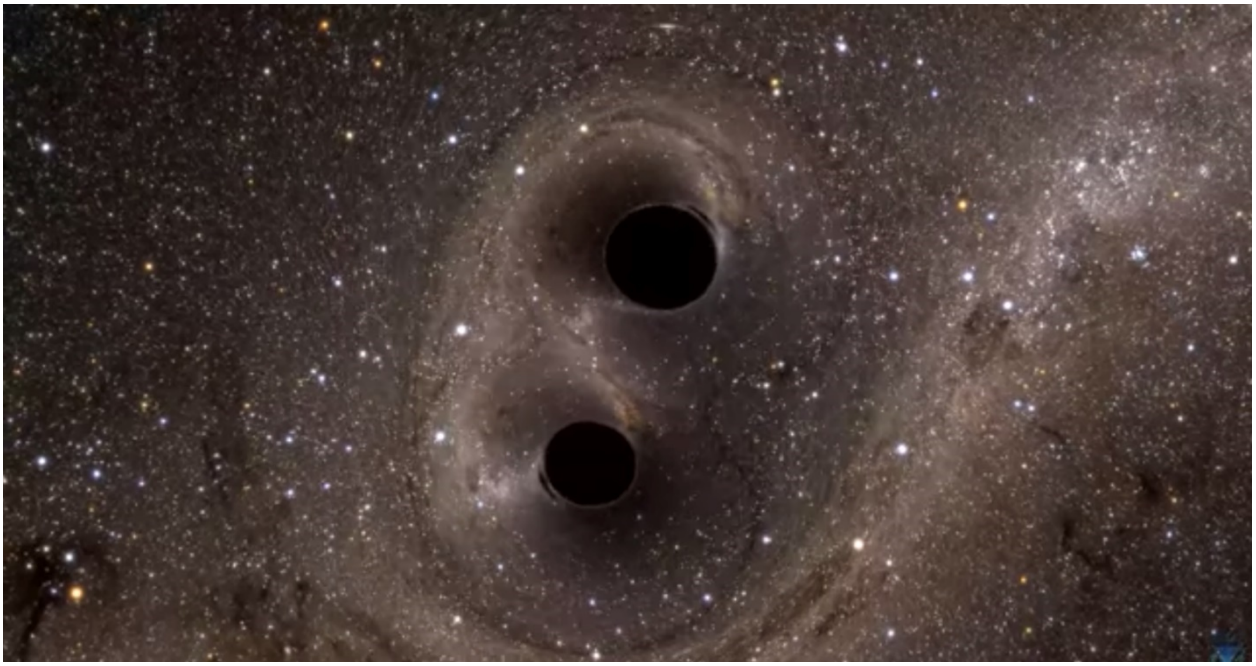
The first visualization of a black hole. By Event Horizon Telescope - https://www.eso.org/public/images/eso1907a/ (image link) The highest-quality image (7416x4320 pixels, TIF, 16-bit, 180 Mb), ESO Article, ESO TIF, CC BY 4.0, https://commons.wikimedia.org/w/index.php?curid=77925953

These black holes are hypothesized to have outflows of matter, known as astrophysical jets, which extend as beams along the poles of the black hole. The velocity of these jets is capable of approaching the speed of light, reflecting the theory of special relativity, or $E=mc^2$.

While the exact mechanism of formation is unknown, Blandford and Znajek have hypothesized that these jets originate from the magnetized disks of gas and dust within a black hole, known as accretion disks. These disks create a magnetic field that is distorted and twisted by the spinning black hole, forming a coil of outwardly expelled matter. This generated electric field accelerates stray electrons, destabilizing the vacuum and causing them to pair with positrons. This pairing leads to the formation of a neutral plasma. As the neutral plasma is accelerated into highly collimated electromagnetic jets (parallel beams of rays), it converts binding and rotational energy into kinetic and thermal energy or heat.[123] This theory of energy extraction from a spinning black hole was first introduced by Blandford and Znajek in 1977.[124]

Two black holes can exist in a binary system, in which they orbit in close proximity to one another. If they venture too close, they collide and merge, releasing an immense amount of energy expelled in the form of gravitational waves. Gravitational waves propagate outward at the speed of light, distorting the curvature of spacetime, like a ripple in the stretched bedsheet. The existence of binary black holes and their emission of gravitational waves were first predicted by Einstein's theory of general relativity. He predicted that the pitch and decay of the massive black hole’s collision would reflect the new black holes mass and spin. Further, he predicted that these ripples would be

"vanishingly small" as they approached earth. A lot has changed since he made these predictions in 1916. Our technological ability to detect these waves has made such advancement that in September 2015, researchers at the Laser Interferometer Gravitational-Wave Observatory (LIGO) did indeed detect the tiniest waves of such a collision. They performed the first observation of a signal of gravitational waves, named GW150914, which was determined to be caused by the merging of a binary black hole at two inferometers, one in Hanford, Washington and the other in Livingston, Louisiana.[125] Einstein predicted a "ring" of the infant black hole born of the merger of two parent black holes, and, as fantastic as it seems, we were able to hear them one hundred years after his prediction and over 1 billion years after their merger.



An image of the simulation of two black holes colliding in the merger of GW150914. Attribution: Simulating eXtreme Spacetimes. The full video of this can be found at https://www.ligo.caltech.edu/video/ligo20160211v3

The recording of the "chirp" or "ring" is nothing short of remarkable in the timing alone. LIGO has been searching for them since 2002. It is estimated that the merger of these black holes occurred 1.3 billion years ago. Think about the fact that the merger of these binary black holes occurred when life on earth was just getting started. It would have been during the Mesoproterozoic era when bacteria and archaea were just starting out as discussed in Chapter 7.[126] LIGO was able to detect the 'chirp' of the two black holes colliding through interferometers, which split light into two laser beams that travel back and forth between two mirrors within the LIGO arms, or ~2.5 mile long vacuum-insulated tubes. The interference pattern created by gravitational waves is detected by alteration of the LIGO arms. The merger that produced GW150914 created a ripple in spacetime that changed the length of the LIGO arm by just 0.001 of the width of the proton-- a change so minuscule that Einstein himself had doubted it would ever be detected. In order for this infinitesimal change to be observed, the technology of LIGO had to be upgraded to increase its sensitivity-- a change that was made just prior to the gravitational waves hitting Earth. In order for this upgrade to take place, LIGO went offline in 2010. When it resumed in 2015, GW150914 was discovered within just two days of its first observational run.[127] Imagine how perfect the timing of that upgrade was, to detect a ripple smaller in size than a proton that came from the collision of two black holes in space, 1.3 billion light years away-- an upgrade that allowed for the recording of something that Einstein predicted a century ago. That alone is mind boggling.

Once researchers detected the signal, scientists at MIT and Caltech were able to convert it to audio waves to hear the ring of the new black hole. The sound it makes evokes a visceral response, a sense of wonder, awe and inspiration engulfed by the

dichotomy of nothingness and everything. If you have not ever listened to it, take a pause to look it up and take it in. This recording can be found at: https://www.ligo.caltech.edu/video/ligo20160211v2

Not only did this discovery provide the first-ever audible "ring" or "chirp" of black holes merging, but it supported the aforementioned no hair Einstein-Maxwell theorem-- these observed black holes lacked all characteristics aside from mass, electric charge, and spin.

Simply Stated

The collision of the two black holes in space detected by LIGO in 2015, actually occurred over 1 billion years ago when life on earth was just getting started. The waves their merger created formed a ripple like a bed sheet being shaken. By the time those waves travelled through space to earth we progressed over a billion years through evolution from tiny bacteria to upright talking humans. A hundred years ago Einstein predicted that we could identify such a collision of two massive black holes and that all that would be detected would be mass, electric charge, and spin, that they would have "no hair". Scientists just so happened to build a research center specifically designed to detect such ripples and to turn on the detectors (think of a seismic detector for an earthquake) two days before the ripples' arrival. Not only that, but they finished a five-year-long upgrade days before the gravitational waves hit Earth, and without this upgrade, they likely would've gone undetected. What are the odds? Now, by the time the ripple in the sheet hit us on earth it had decreased in size from the vibration of a collision 30 times the mass of our sun to the tiniest oscillation like the buzz of a bee. Let's use another

analogy to understand the detection of the infant black hole. Imagine that one of the massive, 1.3 billion-year-old black holes emitted a song, loud and vibrant, like Beethoven's Symphony No. 5: a symphony that could rock the universe. The second black hole, equally as spectacular, played Vivaldi's Four Seasons. When they collided, a baby song was born. Let's call it Pachelbel's Canon in D. The music of the parent black holes, Symphony No. 5 and Four Seasons, would be so loud that it would be almost impossible to hear Canon in D. Now imagine trying to hear that music from around the world. Let's say the songs were being blasted in San Francisco and you needed to hear them in London. It was LIGO's job to find them, to dial down the sounds of the parent's symphonies and tune in to be able to hear Canon in D from across the world. And they were able to do just that. The ring of the infant black hole or Canon in D was isolated-- the chirp of the infant black hole for the whole world to hear.

As you envision this analogy, think once again of the chime that exists in labor and delivery units around the world for every parent to ring when their new baby is born. And now, let's change the timing and take a moment to imagine if that ring could be heard every time a soul is delivered into a biological vessel or zygote. Can you see where we are headed?

The following is an excerpt from a letter sent by MIT President L. Rafael Rife on February 11, 2016. This was a rare occasion, as letters aren't often sent to the MIT community for individual achievements since MIT produces impressive work all the time. This, however, was different.

"Today's news encompasses at least two compelling stories.

First is the one the science tells: that with his theory of general relativity, Einstein correctly predicted the behavior of gravitational waves, space-time ripples that travel to us from places in the universe where gravity is immensely strong. Those rippling messages are imperceptibly faint; until now, they had defied direct observation. Because LIGO succeeded in detecting these faint messages – from two black holes that crashed together to form a still larger one – we have remarkable evidence that the system behaves exactly as Einstein foretold.

With even the most advanced telescopes that rely on light, we could not have seen this spectacular collision, because we expect black holes to emit no light at all. With LIGO's instrumentation, however, we now have the "ears" to hear it. Equipped with this new sense, the LIGO team encountered and recorded a fundamental truth about nature that no one ever has before. And their explorations with this new tool have only just begun. This is why human beings do science!

The second story is of human achievement. It begins with Einstein: an expansive human consciousness that could form a concept so far beyond the experimental capabilities of his day that inventing the tools to prove its validity took a hundred years…

The discovery we celebrate today embodies the paradox of fundamental science: that it is painstaking, rigorous and slow – and electrifying, revolutionary and catalytic. Without basic science, our best guess never gets any better, and "innovation" is tinkering around the edges. With the advance of basic science, society advances, too."[128]

The magnitude of this discovery is unparalleled in astrophysics in the last decade. To be able to hear something in space that Einstein predicted a century ago demonstrates the magnificence of planting a seed. That such a great genius could predict this merger is one thing, but that generations of scientists could go after that discovery-- tend the seed, grow the garden, work together to identify the tree-- that's another. It speaks to the very heart of human ambition, innovation, and spirit.

As above, so below.

It can be seen from the above examples that the way things are done in the fields of both astronomy and quantum mechanics are similar. A scientist proposes an idea, creates a mathematical formula or computer simulation to model it, demonstrates that it is supported by the model, and then they set up the actual experiment to prove it. This is the tale of CERN and the Large Hadron Collider.

Einstein predicted the merger of two black holes in space, simulations were made, humans came together in the name of science, and the ring was found. The same can be said on the microscopic scale. Einstein's theory predicts black holes on the Planck or quantum scale as well. Karl Schwarzschild, a German astrophysicist who proved solutions to Einstein's equations, calculated the size of the event horizon of a black hole and called it the Schwarzschild radius, published in 1916. Based on his calculations, the smallest black hole could have a mass equal to 22 micrograms (the Planck mass). Steven Hawking predicted that black holes would "evaporate" by Hawking radiation, in which the elementary particles we have been discussing (photons, electrons, quarks, gluons) would be emitted. The tinier the black

hole, the faster it would evaporate into a burst of these particles.[129]

Frans Pretorius, PhD and William East, PhD are physicists at Princeton University. They specialize in computer simulations of astrophysics and Einstein's field equations of general relativity. They have simulated black hole mergers and the emission of gravitational waves. Einstein's theory of relativity predicts that it is possible to create microscopic black holes, and he describes the relationship between energy and mass by showing that increasing the speed of a particle causes its mass to increase as well. Computer models based on Einstein's theory give us a view of what would happen at the quantum scale. Targeting two particles at each other in a particle collider, such as the LHC, would focus their energies on each other and create a mass that pushes gravity to the maximum, theoretically creating a microscopic black hole. Simulations by Pretorius and West demonstrate that black holes can form by the collision of particles traveling near the speed of light, and that this formation could occur at lower energies than predicted. When the two particles collide, they behave as gravitational lenses. Through what researchers call the "gravitational focusing effect", these gravitational lenses focus energy into light-trapping areas. Eventually, these areas collapse into a single black hole.[130]

According to Pretorius and East, in a super-Planck-scale collision--a collision between two particles at the smallest level of measure where the total energy (rest energy plus kinetic energy) is greater than the Planck energy (E_P), quantum gravity begins to govern the interaction. At energies greater than E_P, classical gravity dominates. However, the exact point of just how much greater than E_p the transition between classical and quantum gravity occurs remains unknown. Pretorius found that the energy

required to create such microscopic black holes is 2.4 times less than previously thought.[130]

Simply Stated

Theoretically, a black hole can have any mass equal to or greater than the Planck mass (the smallest unit of measure on the quantum scale). Scientists predict that microscopic black holes can exist or be made by the acceleration of particles at the LHC. If they are found, as simulations predict, classical gravity will not hold, and quantum gravity effects will dominate. They would reveal the finding of the graviton, the vector boson for gravity, and in their discovery, it is expected that string theory, superstring theory or M-theory would be proven and would reveal hidden dimensions. The smaller the size of the black hole, the faster it would evaporate.

As we sit with the thought of massive black holes colliding and the search for microscopic black holes that have been proven by simulation, let us switch focus to a discussion of our consciousness entering our body.

Chapter 11: The God Particle, You, and Me

The human body is composed of organs, bones, muscle, hair, and nails. At a smaller level, we are tissues and cells. At an even smaller level, we are DNA, proteins, and lipids, and at an even smaller level, we are atoms. Any smaller, and we have entered the quantum level. Our atoms are made of neutrons, protons and electrons. All of those pieces work together in a coordinated effort to get us up and get us moving. Our DNA receives signals from the mitochondria, which make ATP or usable energy, and vice versa. We respond to our food and the light around us. This begs the question, where does our consciousness come from? If quantum cognition and quantum computing are parallels, as we have seen from Penrose, Hameroff, and Fisher, where does the quantum code that makes us originate? Without the interaction of the Higgs field with the elementary particles that make up each of our atoms, our energy would not be connected to mass, meaning that our consciousness would not be attached to our bodies. And so, the question arises, how would one "reverse engineer" (to use Fisher's words) the quantum cognition that makes us? If consciousness is not held in our brains, but we *are* antennae for light, and if we can function with very little brain tissue, where and when does the light enter or entangle? The moment when the quantum code or qubits are trapped the biological vessel occurs when the human being is in its earliest, smallest, single-celled form-- long before there is a brain or any organs at all.

When this energy or consciousness is attached to the zygote, the brakes are released from the egg. It progresses through meiosis (cell division), becoming two, then four, then eight cells. There is the need for an energy transfer to allow the brake on cell division to be released to unfurl the genetics via mitochondrial ATP production. The egg prepares for just that by amassing up to

600,000 mitochondria (more than any other cell in the human body). This dramatic increase in mitochondria happens in perfect time, just before the zinc spark. The unique identity of each person's consciousness would have to be a long quantum zip code, a massive number of qubits.

Let's return now to the zinc spark, the moment where we see the halo exploding out of the egg. This is the event horizon, the ring, or the chirp. Think of it as the ring that each excited parent sounds when they have their new baby, the ring that tells every sick and injured person lying in their hospital bed that a new soul has entered into this world. The ring that uplifts the tired, the weary, those at the end of their journey. The ring that makes my day every time I go home to my beloved labor and delivery. But instead of it being initiated by the parents at the time of birth, it is initiated by God at the moment of fertilization and now we have the technology to see it. Embryologists use the zinc spark to identify which is the strongest embryo-- the one that should be transferred from the laboratory dish back into the mother's uterus. The sperm and egg are blank slates, ready to receive the new code or consciousness-- the new Higgs field to be attached to the zygote. They are the two halves of the new hole.

According to the first law of thermodynamics, energy and information can neither be created nor destroyed. Therefore, the information that is consciousness must come from and return to a place, a field-- somewhere already in existence. At the merger of the sperm and egg, their independent Higgs fields collide, creating waves of calcium inside the cell that travel at over 250 miles per hour. The zinc atoms waiting at the periphery of the cell explode out in a massive burst of 20 billion atoms to be the antenna that captures the information that is the new code. The particles that collide act like gravitational lenses, focusing energy

into light-trapping areas that collapse into a single black hole, just as Pretorius predicts for microscopic black holes. The Higgs field gives mass to all elementary particles, including quarks, leptons and W and Z gauge bosons. When enough energy arises to excite the Higgs field, it appears as a particle (the Higgs boson). The Higgs boson then decays into the quarks and leptons that make up the new Higgs field of the zygote, providing the free energy to spark the new life.

In other words, at the moment of the collision of the two Higgs fields of the sperm and egg they create a microscopic black hole. The collision of these Higgs fields generates enough energy to create a new Higgs field that is trapped by the 20 billion zinc atoms released. The zinc acts as the antenna for the code or qubits of information from the quantum field, delivering the soul, consciousness or extensive zip code, if you will, to the newly formed zygote, which then allows the release of the breaks on the DNA from the mother and father so that the zygote may develop into a baby. Consciousness is a quantized manifestation of the Higgs field and the energy is transferred to the zygote via a quantum thermoelectric phenomenon that occurs at the instant of the zinc spark.

A Higgs boson with no spin, no charge and no color is formed out of the new quarks and leptons that contain consciousness. This is the new Higgs field of the zygote. The zinc spark is the Mount Rushmore of quantum mechanics. It is the event horizon. The sperm and egg each carry half of the required components. The DNA is there for the code, but it is a blank slate. A new Higgs field ready to trap the code in the atomic spin of the zinc. The leptons and quarks collide, cancelling each other out with the birth of a new Higgs field creating the free energy or the

quantum thermoelectric phenomenon that would spark the zygote.

The black hole created forms an Einstein-Rosen bridge or wormhole through which consciousness is called to the zygote. This is the original "neural qubit", if you will, before there is ever a brain or even a neural tube. The zinc spark that connects consciousness to the zygote at the time of fertilization is the monumental event of quantum field theory. The moment that unifies general relativity and quantum mechanics. This would mark the convergence of astrophysics and particle physics. It would unify human biology, fertilization, and religion. The moment that the soul enters the vessel. The moment that light enters the body. The microscopic ring akin to the ring of the black holes merging in space. And so, just as people in hospitals around the world can hear the ring of the new baby being born, so now can we see the halo of the soul being delivered into the baby. The zygote is the original receiver of light. The visualization of the zinc spark allows all of humanity to see that each of our sparks is real light.

We are God's creation. We are the universe perceiving itself. With every merger of the Higgs fields of the sperm and egg, a new ring resounds, bringing consciousness or a soul into the single-celled zygote that becomes the baby. One day we will have technology to detect this merger at the planck scale and we will have a way to hear it, as LIGO has detected the gravitational waves of black holes billions of light years old. Until then, every time you're in the hospital and you hear the lullaby heralding the delivery of a precious new life, let that be your reminder that we are all created from light. The quantum explanation of how our souls are attached to our vessels. We are receivers for light. The light that comes from the quantum field of energy that surrounds

us, that permeates every nook and cranny within us and between us. The words may change across space and time, but the meaning remains the same.

Every Jedi has a teacher

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