Modern Science and the Bible

1 – Over the past few hundred years, there has been a widening gulf between science and Christianity. The popular perception today is that science and the Bible contradict each other. However, over the past 100 years scientists have made some amazing discoveries that have affirmed the truth of God's eternal word. Psalm 19:1 says that God's creation declares his glory, and that declaration has never been more clear than it is today in your and my lifetime. Tonight I would like to look at exactly *how* the heavens declare the glory of God. I'd like to look at the relationship between modern science and the Bible and show how they affirm and support each other.

2 – But why should we worry about science at all? Why should we even care whether science supports the Bible? We believe in the Bible, we've been saved. Why should we care what science says? The pronouncements of scientists will not affect our faith.

The first point to realize is that God reveals himself through science. This is called "general revelation." It is God's revelation of himself to all people at all times and in all places. Psalm 97:6 says, "The heavens proclaim his righteousness, and all the people see his glory." As we investigate science we see the glory and the righteousness of God. We can see his power, his creativity, his beauty, his precision and order. God does not call all of us to be scientists any more than he calls all of us to be professional theologians. But he does call each of us to heed his revelation of himself – his general revelation in nature as well as his special revelation in his Word (the Bible).

The second point is that even if *you* don't care about science, your friends or your children may care about science. We live in a world that has virtually deified science. The world believes that a religion that contradicts science is a religion that is not worth investigating. 1 Peter 3:15 says that we ought to always be prepared to defend our faith. Can we defend our faith to our high school son or daughter who comes home from school and tells us that science has disproved the Bible? Can we defend our faith against our neighbor who believes that science and the Bible contradict? Can we defend our faith against our coworker who believes that Genesis 1 is a myth? My hope is that this presentation will take us one step closer to being able defenders of God's word in a world that is dominated by science.

3 – Now before we begin I have to clarify the assumptions of this presentation. The title of the presentation is "Modern science and the Bible," so I will be dealing with the findings of modern science. When I say "modern science" I mean "mainstream science." Modern science claims that the universe began with a big bang about 14 billion years ago and the earth is 4.5 billion years old. You may not believe in the big bang, and you may not believe in an old Earth, but modern science is virtually unanimous in these beliefs. So my approach is to show how modern mainstream science testifies to the truth of the Bible. Whether the earth is old or young is a controversial subject in Christianity and it is worth a separate discussion. For now I will ask you, for the sake of argument, to grant the modern scientist his belief in a big bang and an old earth. Perhaps it is not true that the universe and the Earth are billions of years old. But for the purposes of this discussion I will assume that modern science is correct that the universe and the Earth are old, and I will proceed from that point to show how modern science testifies to the truth of the Bible.

4 – We start … in the beginning! The Bible says that in the beginning God created the heavens and earth, that is, God created the entire universe. This is a picture, an actual photograph, of the universe about 12 billion years ago. Astronomy is the only science where we can directly observe the distant past. It takes 8 minutes for light to reach us from the sun, so when we look at the sun we are actually seeing it as it was 8 minutes ago. We are seeing 8 minutes into the past. As astronomers develop more powerful telescopes, they can see farther away, which means that they can actually see the universe as it was billions of years ago.

5 – The first discovery of science that supports the Bible is that universe indeed had a beginning. Less than 100 years ago almost all scientists believed that the universe had always existed. It wasn't created. It just always was. But then Albert Einstein came along and formulated his theory of relativity in 1915. The theory of relativity has been confirmed by hundreds of experiments, and it implies that the universe and time itself had a beginning about 14 billion years ago. Before 14 billion years ago there was no space and there was no time. There was nothing. There was not even empty space. There was not even time. There was nothing. But then, somehow, the universe and time itself began. But if the universe and time had a beginning, who began it? Something with an existence above and beyond the universe, something with an existence above and beyond time, must have created time and the universe, just as the Bible claims.

6 – Scientists were very disturbed with the idea of a beginning to the universe, because they realized that a beginning would support religion. And scientists are adamant about keeping God out of their science. They realized that a beginning would support the existence of God. If the universe had a beginning then God is required to explain how the universe began. Arthur Eddington was one of the greatest physicists of the first half of the 20th century. He said, ""Philosophically, the notion of a beginning of the present order of nature is repugnant to me." He wanted to believe in a purely natural universe, but when confronted with the theory of relativity, he realized that a God must have begun the universe. Interestingly, Eddington was a religious man (a Quaker) but he insisted on viewing the universe in a purely naturalistic way, without any intervention by a supernatural God.

Eddington said that "religion first became possible for a reasonable scientific man about the year 1927." The year 1927 was when Edwin Hubble showed that galaxies are moving away from us. This provided confirmation for the theory of relativity and confirmation for the idea of a beginning to the universe.

Eddington and Einstein were the only scientists who understood relativity for the first 10 years or so. Once when a journalist asked Eddington how many people understood relativity, he answered, "Two, and I'm not sure about the other guy." The "other guy" he referred to (tongue in cheek) was Albert Einstein. Eddington was the first scientist who measured the bending effect that gravity could have on light.

7 – Robert Jastrow is one of the great scientists of the 20th century. He was the founder and director of NASA's Goddard Space Center. He is an agnostic – he does not believe in God. Here are his thoughts about the big bang. "The Universe flashed into being, and we cannot find out what caused that to happen. This is a distressing result for scientists." It is distressing to Jastrow because the only possible explanation is a God who lives outside of space and time.

8 – To Christians, Einstein's theory of relativity should not have been surprising. Einstein proved that time had a beginning, but he was not the first one to affirm that time had a beginning. The apostle Paul wrote 2000 years ago that time had a beginning. Scientists never believed it until the past 100 years when Einstein's theory of relativity and experimental evidence confirmed that space and time both began about 14 billion years ago.

9 – The creation event that scientists call the big bang was fine tuned to allow for the formation of stars and planets. When the universe was one second old, if its expansion had been one 1000th of a 1000th of a 1000th of a 1000th of a 1000th of a percent higher, then all the matter in the universe would have dispersed so rapidly that stars and planets would never have formed. We would not be here. On the other hand, if its expansion had been one 1000th of a 1000th of a 1000th of a 1000th of a 1000th of a percent lower, then all the matter in the universe would have collapsed back on itself because of gravity, and again, we would not be here.

10 – How hard is it to be this precise? Suppose that you need to adjust the speed of your cruise control on your automobile to 60 mph with this accuracy. So you set the cruise control and you travel for forty years. You get good gas mileage so you don't have to stop for gas. After forty years you've traveled around the world over 800 times. You've traveled exactly 21,024,000 miles. If you are off by more than 15 microns (one hair width) then your tuning was not accurate enough. That's how accurately the expansion of the big bang had to be fine-tuned in order to allow for the existence of the universe.

11 – Stephen Hawking is the greatest scientist alive today. He writes, "The initial state of the universe must have been very carefully chosen indeed. It would be very difficult to explain why the universe should have begun in just this way, except as the act of a God who intended to create beings like us." Hawking does not believe in God. He is an outspoken atheist. But he recognizes that the fine-tuning of the big bang points to a creator. The fine-tuning of the big bang is recognized by atheists, agnostics, and Christians alike. The data I'm sharing tonight is not only claimed by Christians, it is well known by all scientists.

12 – But not only was the big bang fine-tuned, gravity was also fine-tuned. If force of gravity was slightly stronger, all stars would be larger than our sun because their stronger gravity would suck in more matter from outer space. Larger stars burn more rapidly than smaller stars. These larger stars would burn too rapidly and inconsistently to support life. The fluctuations in the intensity of their burning would result in huge temperature variations in their solar systems, and life could not survive.

What if gravity was weaker? Surely that would be a good thing. It would be easier to get out of bed in the morning, our muscles wouldn't sag so much as we got older. Scientists believe that the heavy elements on planets came from exploding stars. All of the heavy elements on Earth came from stars that exploded billions of years ago. If gravity was slightly weaker, all stars would be smaller than our sun. Smaller stars do not create as many heavy elements as larger stars (e.g., oxygen, carbon, iron). The lack of heavy elements on planets would prevent the survival of life.

Gravity has to be tuned to greater than one 1,000,000th of a (… 6 times) of a percent (relative to electromagnetism) in order for human life to exist in our universe. This is an accuracy of 10--40. How hard is it to be this precise?

13 – It's hard to visualize this level of precision, but here's an analogy. Cover the entire world in dimes all the way up to the moon, a height of about 240,000 miles. Now suppose each of the 6 billion people on Earth have 8 of their own worlds. That makes 48 billion worlds. Pile dimes from here to the moon on 48 billion other worlds the same size as Earth. Paint one dime red and mix it into the 48 billion piles of dimes. Blindfold a friend and ask him to pick out one dime. The odds that he will pick the red dime are the same as the fine tuning of gravity in our universe. If he picked out the right dime, would you think it was just a coincidence?

14 – Carl Sagan said, "It is easy to see that only a very restricted range of laws of nature are consistent with galaxies and stars, planets, life and intelligence." Sagan was an outspoken atheist, an astronomer, and a science educator. He was no friend to Christianity. He was very outspoken in his criticism and even ridicule of Christianity. But he recognized the fine-tuning of our universe.

15 – So the big bang and gravity were fine-tuned. But the mass of the universe was also fine-tuned. In fact, if the universe had one 1,000,000th of a (… 10 times) percent more or less mass, no stars or planets or galaxies would have formed. Again, more mass and the universe would have collapsed back on itself shortly after the big bang. Less mass and the universe would have expanded so rapidly (because of the smaller gravitational forces) that no stars or planets would have formed. This is an accuracy of 10^{-62}. How hard is it to obtain this type of accuracy?

16 – The fine-tuning of the mass of the universe is like fine-tuning the mass of the earth to within less than one grain of sand. That's how accurately the mass of the universe had to fine-tuned at the moment of creation in order for the universe to exist as we know it.

17 – Paul Davies writes, "It seems as though somebody has fine-tuned nature's numbers to make the universe … the impression of design is overwhelming." Davies is an Australian physicist, one of the most accomplished physicists of our generation. He is a widely published author who believes in God but is not religious. He is not a Christian, but as a physicist he recognizes the fine tuning in the universe and that leads him to a persuasion that something or someone supernatural must be behind it all.

18 – But it is not only the design of the *universe* that is fine-tuned by our creator. This is a photograph of our beautiful planet, showing Africa and the South Pole, taken by Apollo astronauts. The Bible says that God created the Earth and that God was personally involved in the design of the Earth and its life forms. God fine-tuned his design of our planet so that life (and so that we) could thrive on it.

19 – This is a view of a typical spiral galaxy. Note the spiral arms, which are caused by the rotation of the entire galaxy. Our galaxy, the Milky Way, is a spiral galaxy.

20 – This is a view of our Milky Way galaxy as it would appear edge on. It's like looking at the edge of a spinning Frisbee. The white masses that you see are stars. Our galaxy has about 100 billion stars. Our Solar System is located near the edge of the galaxy in a relatively unpopulated region ***between*** spiral arms. We live in a rural area of the galaxy. Lucky for us for several reasons. First of all, this region gives us an excellent view of our galaxy and universe (unobstructed by the many stars found in more crowded parts of our galaxy). It almost appears as if God has allowed us the best possible location for us to see how "the heavens declare the glory of God" (Psalms 19:1).

More importantly, this is the only region of the galaxy where life can survive. 98% of the material in the universe is hydrogen and helium, the two simplest elements in the universe. But man does not live on hydrogen and helium alone. A planet that contains life must be close enough to the center of a galaxy so that enough heavy elements exist to support life (iron, oxygen, sodium, nitrogen, carbon, etc., are required to support photosynthesis, respiration, other enzyme-based processes). But if we were too close to the center of the galaxy we would be susceptible to radiation because of the large number of stars (including exploding stars).

21 – Astronomer James Trefil writes, "If I were a religious man, I would say that everything we have learned about life in the past twenty years shows that we are unique, and therefore special, in God's sight." Apparently he is not religious, but Trefil estimates the probability of life existing *anywhere* in the universe to be one in a billion.

22 – But not only does the solar system have to be the right distance from the galaxy center, the distance between a planet and its star has to fine-tuned in order for life to be able to exist. This "life zone" is a very small zone, in which water can exist in all three of its forms - gas, liquid, and solid (ice). Without liquid water, life is not possible. If the planet is too far from its sun, then liquid water will not exist because of cold temperatures. If the planet is too close to its sun, then liquid water will not exist because of high temperatures.

23 – Allan Sandage (1926-) writes, "We can't understand the universe in any clear way without the supernatural." Sandage was one of the top astronomers of the 20th century, receiving numerous international awards. He is also a Christian, still living today in Pasadena.

24 – The size of a sun is also crucial for its ability to support life. Large stars undergo rapid and unstable burning (extreme temperature variations), which is not conducive to life. Stars increase in brightness as they age. For example, our sun has increased its energy output by 35% since its beginning. Fortunately for the Earth, this change has been compensated by a decrease in the levels of greenhouse gases (more plants, less carbon dioxide), which lowered the ability of the Earth to hold onto the increased heat produced by our more luminous Sun. For stars larger than our Sun, the increase in energy output is much greater, which could not be compensated. In addition, large stars have short lifespan because of their rapid burning.

Stars smaller than our Sun are also not suitable to support life on planets. Although these stars have stable burning, their small mass requires that life-containing planets be much closer to the star. Planets within the life zone have to be so close to the star that the gravitational interaction (which increases with the square of the distance) causes the planet's rotational period to be reduced significantly. For example, both Mercury and Venus have rotational periods that are as long or longer than their revolutionary period. These 88 and 243 Earth-day rotational periods (for Mercury and Venus, respectively) result in extremes of temperatures on the surface of these planets, which prevents the survival of life.

25 – Sir Francis Crick (1916-) is quoted in Scientific American as saying, "The origin of life appears to be almost a miracle." Crick won the Nobel Peace Prize for his discovery of DNA (with James Watson). He is an atheist. He has made it clear that he does not believe in God. Yet he recognizes that the existence of life defies natural explanation.

26 – Another unique aspect of our solar system is that Earth is protected from cometary bombardment by two huge gas planets (Jupiter and Saturn). This picture is not drawn to scale. Actually, Jupiter is more than 10,000 times as large as Earth! (Saturn is almost as large as Jupiter.) Scientists estimate that the Earth would receive 1,000 times as many comet impacts if these planets were not where they are. Such a large number of cometary collisions would prevent the existence of life on Earth. Jupiter and Saturn (because of their huge size and high gravity) reduce the chance of major comet collisions from every 100 thousand years to every 100 million years. Last major cometary impact was 65 million years ago when dinosaurs were wiped out, which allowed for the survival of larger land based life forms. Too few bombardments and dinosaurs would still rule the earth and humans would not be able to survive. Too many bombardments and no life would survive on Earth.

27 – Tony Rothman, a physicist, writes, “When confronted with the order and beauty of the universe and the strange coincidences of nature, it’s very tempting to take the leap of faith from science into religion. I am sure many physicists want to.” Rothman has made many contributions to big bang theory. He refuses to state his religious persuasion, so apparently he is not a Christian. But still he recognizes that our universe, solar system, and Earth have somehow been fine-tuned to allow the existence of life.

28 – Not only has the Earth been fine-tuned to allow for the existence of life, the moon has been specially created to allow life to exist on Earth. We take it for granted, but the presence of the moon is absolutely vital to the Earth's ability to host life. Without the moon, the Earth would be a barren, scorched planet, similar to Venus. Why does Earth need the moon in order to host life?

29 – The prevailing scientific explanation for the moon's existence is that a Mars-sized object crashed into the earth around 4.25 billion years ago. (All moon rocks have been dated to this age.) The probability of such a collision is extremely remote. Any "normal" collision would not have resulted in the formation of the moon, since the ejected material would not have been thrown far enough from the earth to form the moon. The Mars-sized object, before it collided with the earth, must have had an unusually elliptical orbit (unlike the orbit of any other planet in the Solar System), which resulted in a virtual head-on collision with Earth. The collision of this object with Earth resulted in the ejection of 5 billion cubic miles of Earth's crust into orbit around the earth. This material, the theory states, then coalesced to form the moon. The moon is moving away from the earth (currently at 2 inches per year), as it has been since its creation. If we calculate backwards we discover that the moon originally formed 7,300 miles above the earth's surface (now it is about 240,000 miles away).

30 – So what’s so special about the moon? Would we really miss it if it had never formed? The collision of the Mars-sized object with the earth resulted in the ejection of the majority of the earth's early atmosphere. If this collision had not occurred, we would have had an atmosphere similar to that of Venus, which is 80 times more dense than that of the earth (equivalent to being one km beneath the ocean). Such a thick atmosphere on Venus resulted in a runaway greenhouse affect, leaving a dry planet with a surface temperature of 800º F. In fact, the surface temperature of Venus is higher than that of Mercury, which is even closer to the Sun. Earth would have suffered a similar fate if the majority of its early atmosphere had not been ejected into outer space by the collision that formed the moon. In fact, Earth is 20% more massive than Venus and further away from the Sun, both factors of which *should* have led to an atmosphere much thicker than that of Venus. For some strange reason, we have a very thin atmosphere - just the right density to maintain the presence of liquid, solid and gaseous water necessary for life. If the moon hadn’t formed from this huge collision billions of years ago, Earth would not be able to support life.

31 – The moon is important for another reason too. Before the moon was formed, the Earth was rotating on its axis every eight hours. Such a rapid rotational period led to winds in excess of 500 mph. The moon, which was less than 10,000 miles from the Earth at the time it formed, exerted large gravitational forces that slowed the rotation of the Earth to its current 24 hours. If the moon had never formed, the Earth's rotational rate would still be too rapid, which would lead to high winds and conditions that would be unsuitable for advanced life forms. Jupiter has a rotation of 10 hours and winds that *average* 1000 mph!

32 – Robert Naeye writes, "On Earth, a long sequence of improbable events transpired in just the right way to bring forth our existence, as if we had won a million-dollar lottery a million times in a row." Naeye is an astronomer and writer with unknown religious persuasion.

33 – Scientists believe that another fortunate result of the collision that formed the moon is the presence of Earth's large and heavy metallic core. The collision that formed the moon deposited a large amount of heavy metal to the Earth's crust. In fact, the Earth has the highest magnetism of any of the planets in our Solar System. Earth's large nickel-iron core is responsible for our large magnetic field. This magnetic field produces the Van-Allen radiation shield, which protects the Earth from radiation bombardment from space. If this shield was not present, life would not be possible on the Earth. The only other rocky planet to have any substantial magnetic field is Mercury - but its field strength is 100 times less than the Earth's. The magnetic field of Mars is at least 1,000 times less than that of the Earth. Even Venus, our sister planet, has no magnetic field. The Van-Allen radiation shield is a design unique to the Earth. But if Earth's magnetic field was too large then we would experience a greater number of lightning storms, which would not be conducive to life.

34 – To this point we have discussed only a few of the features of the universe and Earth that had to be fine-tuned in order to allow for the possibility of life. Actually, scientists have discovered over 200 factors about the Earth that needed to be carefully designed in order to allow for life. In the next few slides I'll show just a few of these 200 factors, along with the probability that these factors would have the correct values in order to support life.

35 – Galaxy type -- For instance, only a spiral type galaxy (like our Milky Way) can support life. Other types of galaxies are either too volatile to allow for life, or do not have enough heavy elements to support life. About 5% or 10% of the galaxies in our universe are spiral galaxies, so the probability of any particular galaxy being spiral is 0.1.

Star location in galaxy -- We already discussed star location. A star too close to the center of its galaxy will be bombarded with too much radiation, but a star to far from the center of its galaxy will not have enough heavy elements to support life.

# of stars in solar system -- The number of stars in the solar system has to be exactly one. Less than one and we would not have enough heat. More than one and our orbit would be unstable.

Birth date of star -- If the star's birth date was too early then the solar system would not have had enough heavy elements (having formed too early in the history of the universe). If the star's birth date was too late then its burning would be too unstable to allow for life in its solar system.

Age of star – If the star was too young or too old then its burning would not be stable enough to support life.

Mass of star – If the star was too massive then its burning would be too unstable. If the star was not large enough then the planet would have to be closer to the star to have liquid water. The close distance between planet and star would cause the planet's rotation period to be too long, resulting in temperature extremes and radiation levels that would not allow for life.

Brightness of star – If the star was too bright too soon, then a runaway greenhouse effect would occur on the planet. If the star was not bright enough then a runaway ice age would have developed on the planet.

Color of star – If the star was more blue or red, then photosynthesis would have been insufficient to develop plant life.

Supernovae rates / proximity – A supernova is an exploding star. If supernovae were too close to Earth or too frequent then life would be exterminated by radiation. If supernovae were too far away or too infrequent at the beginning of Earth's history then there would not be enough heavy elements to support life.

The source of this data is Hugh Ross, "The Creator and the Cosmos," www.reasons.org

36 – White dwarf rates / proximity -- A white dwarf is a star the collapses on itself, unable to maintain its size because of its own gravity. If white dwarves around our solar system were too few or too far then there would not be enough fluorine in our solar system to support life. If there were too many white dwarves around our solar system then our orbit would be disrupted by the huge masses of the white dwarves.

Distance from star – Our planet has to be within a narrow "life zone" to allow for water to exist in all three states (liquid, solid, and vapor) and to allow for a stable water cycle.

Axis tilt – If the tilt of the rotation axis was too large then there would be huge temperature variations on the planet.

Rotation period – If days were too long then temperature differences between night and day would be too great. If days were too short then winds would be too high.

Orbit eccentricity – Earth's orbit is almost circular (within 3%). If it was too eccentric then temperature differences between seasons would be too large.

Surface gravity – If gravity was stronger then the atmosphere would be thicker, resulting in a runaway greenhouse effect. If gravity was weaker then too much water vapor would be lost to outer space.

Tidal force – If the tidal force due to the moon was stronger, we would have a day that was too short (high winds) and flooding. If the tidal force was weaker then there would be insufficient movement of nutrients between water and land.

Magnetic field – If the magnetic field was too strong then we would experience severe electromagnetic storms. If the magnetic field was too weak then we would be too susceptible to radiation from outer space.

37 – Albedo – This measures how much light from the sun is reflected back to space. If albedo was too high then Earth would be too cold and a runaway ice age would develop. If albedo was too low then Earth would be too warm and a runaway greenhouse effect would result.

Thickness of crust – If Earth's crust was thicker then too much oxygen would be transferred from the atmosphere to the crust. If it was thinner then there would be too much seismic activity.

Ocean / continent ratio – If there was too much land on Earth then the earliest life forms would not have had a chance to develop in the water. If there was too much water on Earth then complex life forms would not have developed on land.

Asteroid / comet collision – If there were too many asteroids or comets colliding with Earth then life would become extinct. If there were too few asteroids or comets then Earth would be depleted of elements necessary for life.

Atmospheric transparency – If the atmosphere was more transparent then the earth would overheat. If it was less transparent then the a runaway ice age would develop.

Atmospheric pressure – If it was too small liquid water would evaporate too easily and condense too infrequently; weather and climate variation would be too extreme; lungs would not function. If it was too large liquid water would not evaporate easily enough for land life; insufficient sunlight would reach the planetary surface; insufficient uv radiation would reach the planetary surface; insufficient climate and weather variation; lungs would not function.

Electrical activity – If there was more electrical activity in the atmosphere then we would be susceptible to electromagnetic storms and fires. If there was less electrical activity then there would be too little nitrogen in the atmosphere.

Quantity of metals – If the quantity of metals in Earth's crust (such as sulfur, iron, cobalt, arsenic, copper, boron, fluorine, iodine, manganese, nickel, phosphorous, tin, zinc, molybdenum, vanadium, chromium, selenium, silicon) was much different then plants and animals would not have the proper nutrients to survive.

38 – Carbon dioxide level – If it was greater a runaway greenhouse effect would develop. If it was less plants would be unable to maintain efficient photosynthesis.

Oxygen level – If it was greater plants and hydrocarbons would burn up too easily. If it was less advanced animals would have too little to breathe.

Ozone level – If it was greater surface temperatures would be too low (too little radiation from space). If it was less surface temperatures would be too high; there would be too much uv radiation at the surface of Earth.

Nitrogen level – If it was greater there would be too much buffering of oxygen for advanced animal respiration; too much nitrogen fixation for support of diverse plant species. If it was less there would be too little buffering of oxygen for advanced animal respiration; too little nitrogen fixation for support of diverse plant species.

Position and mass of Jupiter – If it was too large or too close, Earth's orbit would not be stable. If it was too small or too far, too many comets would impact Earth (comets that are now shielded from Earth by Jupiter).

Seismic activity – If it was greater too many life forms would be destroyed. If it was less nutrients on ocean floors from river runoff would not be recycled to continents through tectonics; not enough carbon dioxide would be released from carbonates

The total probability is 10 to the minus 50th power, which is equal to one 1,000,000th of a 1,000,000th of … (eight times) percent.

39 – Consider that the universe contains about 100 billion galaxies, each of which contain 100 billion stars. Suppose there are ten planets per star (actually most stars do not have planets). Then there are 10^23 planets in the universe. That means that there is a one in 10^(-27) chance of life existing *anywhere* in the universe. Those are odds of about one out of 1 billion billion billion. These odds are difficult to fathom, but let's try.

40 – I've got a special grain of sand. You need to find it. It might be on this beach. But it might be on any other beach in the world. You see, there are about 1 billion billion billion grains of sand in the world (the same as the odds on the previous slide). You are free to roam the world and bring one grain of sand back to me. I will tell you if you picked the right one. Your odds of picking the right grain of sand are the same as the odds of any planet existing anywhere in the universe that is capable of supporting advanced life (beyond a virus or bacteria). I'll give you any odds that you like that you can't pick the right grain of sand. Just as I'll give you any odds you like that our existence in this universe must have been planned by a supernatural creator.

Actually we only listed 31 parameters that need to be fine-tuned to support life. We could list 200 parameters that need to be fine-tuned in order to support life, which reduces the probability to 10^{-237}.

41 – Fred Hoyle writes, "A superintellect has monkeyed with physics, as well as with chemistry and biology." Hoyle was one of Britain's most famous and respected scientists of the 20th century. He was the "Carl Sagan" of Britain, an astronomer and an outspoken atheist. Yet he recognized that the natural laws of science are so finely tuned that something or someone must have intervened in the design of the universe.

Hoyle is the one who originally coined the term "big bang." He meant the term in a disparaging way, as if to belittle the idea that the universe started with a "big bang." More and more of his fellow scientists accepted the big bang theory as the evidence mounted, but Hoyle spent his life looking for an alternate explanation, because he knew that if he accepted the big bang, then he would have to accept the idea that the universe had a beginning, which would mean that something or someone began the universe.

42 – Speaking of the odds that life could have arisen by purely natural processes, the atheist Fred Hoyle writes, "What are the chances that a tornado might blow through a junkyard containing all the parts of a 747, accidentally assemble them into a plane, and leave it ready for take-off? The possibilities are so small as to be negligible even if a tornado were to blow through enough junkyards to fill the whole universe." Hoyle refused to believe in God, but he recognized the insurmountable odds of life arising by natural means. He spent his life avoiding God as a solution to the mystery of life, he spent his life searching for an explanation that excluded God, and he died without an answer. "Always learning but never able to come to the knowledge of the truth" (2 Timothy 3:7).

43 – David wrote in the eighth Psalm, "When I consider your heavens, the work of your fingers, the moon and the stars, which you have set in place, …"

(Actually this is Jupiter's moon Callisto.)

44 – "What is man that you are mindful of him, the son of man that you care for him?"

When David looked up at the night sky 3000 years ago, he was overwhelmed with the impression of beauty and design. When we, with our scientific theories and advanced instruments, examine our universe, we too are overwhelmed with the impression of beauty and design. We know that there must be a God who created it all, and yet it is beyond comprehension that such a mighty God would care for such insignificant creatures as us. Our galaxy is a speck of dust in the universe. Our solar system is a speck of dust in our galaxy. Our planet is a speck of dust in our solar system. And we are but specks of dust on our planet. And yet God, the creator of it all, loves us enough to die for us.

45 – Paul wrote that since the creation of the world God's invisible qualities are clearly seen from what he has created. As we look into the heavens we catch of glimpse of God – his power, his might, his creativity, his beauty, his attention to detail and order, his extravagance. And we also see his love for us, a love that fine-tuned an entire universe for our benefit.

46 – A few slides ago we briefly looked at 31 parameters that needed to be fine-tuned to support life. We could actually list over 200 parameters that needed to be fine-tuned in order to support life, which reduces the probability of any planet existing with the capability to support life to one out of 10^{237}.

47 – These are the same odds as flipping a coin and getting heads 787 times in a row. If I flipped a coin and got heads 787 times in a row, would you want to bet that I would get tails the 788^{th} time? You would be absolutely certain that I had a two-headed coin. If you had to bet, you would bet that the next flip would be heads again. And that is exactly what we are doing as Christians. We see the design in the universe, and we say, "I bet that it's more than just a coincidence. I bet that there is a Creator," because 787 heads in a row is too many to be a coincidence. The design that we see in the universe is too much to be a coincidence. And it's a great bet because if we're wrong, what have we lost? But if we're right we get to go to heaven for an eternity of happiness.

But the nonChristian is betting that the next coin flip will be tails. The nonChristian thinks that those 787 heads in a row are just a coincidence, and that the next flip will be tails. And it's a bad bet, because if he is right, what has he gained? But if he is wrong … well, he's taking a terrible risk.

48 – Let's briefly summarize the material we've looked at tonight.

First, God reveals truth through science. Psalm 19: "The heavens declare the glory of God." So as Christians we do not need to be afraid of science, and we do not need to be defensive in the presence of science. The more truth that scientists discover, the more the Bible will be affirmed.

Second, your gifts and your calling may have nothing to do with science, and that's fine. But each of us needs to be prepared to give an answer for the hope that lies within us (1 Peter 3:15). So educate yourself in matters of science because even if you are not interested in science, those who you're close to may be, and that might be your opportunity to be salt and light in their lives.

Third, the big bang affirms the truth of the Bible, because the big bang says that there was a beginning to the universe and a beginning to time, just as the Bible says that there was a beginning to the universe and a beginning to time. Before the 20th century, science had no reason to believe that the universe or time had a beginning, but scientific discoveries tend to affirm the truth of the Bible.

Fourth, science recognizes the fine-tuning of the universe and Earth that is required to support life. Nonchristian scientists recognize the amazing coincidences that are required for the existence of intelligent life. They try to find other ways to explain this fine-tuning, but for those of us who believe in the Bible, the fine-tuning that we see is evidence for the truth of the Bible. The design that we see around us is evidence for a designer.

These are some of the things that we need to communicate with our nonchristian friends. Very few people will turn to Christ on the basis of scientific evidence. But some nonchristians have honest intellectual doubts about the truth of the Bible. If we can remove intellectual roadblocks from their lives, then they are that much closer to Christ.

49 – In conclusion I would like to acknowledge the many wonderful resources that I've drawn on for this material, some secular and some Christian, many books and many internet sites. If I had to recommend one book I would recommend the Christian book "Show Me God," by Fred Heeren. It is a fascinating and entertaining book that is chock-full of information. My favorite web sites are reasons.org, which is the web site of Reasons to Believe, which is an organization that is run by a Christian astrophysicist, and asa3.org, which is the web site of the American Scientific Affiliation, which is a professional organization of several thousand members who are interested in the relationship between Christianity and science. Both web sites are full of useful and fascinating information and resources.

50 – Finally I will mention that if anyone is interested in getting a copy of this PowerPoint presentation, it can be downloaded from my web site, which is listed here. However, be aware that the file is about 10 MB, which means it would take about two hours to download using a typical 56K modem.

One thing I want to mention is that it is possible that life exists on other planets, and scientists are spending a lot of time and effort to investigate this possibility. The enormous odds I've discussed today against life existing on other planets applies only to advanced life forms, not to primitive life (like bacteria or viruses). So I will not be at all surprised if some day bacteria are found on other planets. Furthermore, it is possible that God created advanced life on planets other than Earth, and discoveries of that sort would in no way reduce the odds that we've discussed in this presentation.

There are some other topics that may be of interest to those interested in the relationship between science and Christianity. For instance, throughout this presentation I've assumed that modern science is essentially correct in its statements that the universe and the Earth are billions of years old, and I've assumed that the creation event recorded in Genesis 1:1 is identical with the big bang. I do not claim that modern science is correct in these statements. The purpose of this presentation has been to demonstrate that *if* modern science is correct, then modern science affirms the truth of the Bible. Of course, many Christians claim that Earth is only a few thousand years old, and the age of Earth and the universe is a point of heated contention in some circles. There is Biblical and scientific support for the claim that Earth and the universe are only a few thousand years old, and there is Biblical and scientific support for the claim that Earth and the universe are billions of years old. Christians need to be made aware that there are two sides to this 'age of the Earth' controversy.

Another related topic is Noah's flood. Scientists are adamant that a global flood has not occurred within the past few thousand years. Some Christians are adamant in their insistence that Noah's flood was indeed global. Other Christians say that Genesis can be interpreted in such a way that Noah's flood was restricted to the Mesopotamian area of Earth. Again, Christians need to be made aware that there are two sides to the Noah's flood controversy. There are valid Biblical and scientific arguments on both sides of the controversy.

A more general topic is how we can integrate science and scripture. Does God reveal truth through both science and scripture on the same topic? If so, how should we respond when science and scripture both speak on the same subject? Should we interpret science in light of scripture? Should we interpret scripture in light of science? How do we react when science and scripture seem to contradict? In many ways our answers to these questions will determine how we interpret the creation account in Genesis 1, and Noah's flood a few chapters later.

Finally, Genesis chapter one, which discusses creation, has been interpreted by Christians in at least a half-dozen different ways. Most Christians interpret it such that the six days

of creation represent six literal 24 hour days, because this is the most straightforward interpretation. However, other Christians interpret the creation days as topical divisions, or days of revelation, or as eons of indeterminate length. Each interpretation has features which lend to its support and other features which detract from its support. Too often Christians believe in one interpretation because that's the way they've been taught, or because they are not aware of any alternatives. Christians need to be made aware of the various interpretations of Genesis chapter one in order to arrive at their own well-informed convictions.

The relationship between science and Christianity is something of a passion for me, so I would be delighted in opportunities to make presentations on any of these other topics.