

Hedonism and Heresy

A Brief Critique
of Dan Brown's Book
Entitled, *Angels and Demons*

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As most of our readers know, I am a former homicide detective. As such, I am accustomed to doing both interviews and interrogations. At times, I catch myself interrogating when I should be interviewing and others, interviewing when I should be interrogating. When I began this article I began as an interrogator, however upon some godly counsel I hope I became more of an interviewer. This paper is meant to be a kinder, gentler approach to Dan Brown's book and not the rough tough interrogation of his work. However, at times I may cross the line with some of my statements from interviewer to interrogator. Please bear with me.

I enjoy reading mysteries, but must be cautious and alert to what I read to see if the book contains any underlying currents. Dan Brown writes some very readable books. They are simplistic and yet exciting and this adds to their appeal. However, contained within the pages of his material are some untruths that may deceive certain readers? Thus, the audience of Dan Brown needs to be warned.

Dan Brown is once again making a profit¹ from another work full of theological error, though at the beginning of the book he states of some of his material, 'it's just the facts.'² We have witnessed *The Da Vinci Code* success both in print, at the box office, and now we are witnessing, once again, another successful book, and its soon to be released Hollywood counterpart.³

¹ Titus 1:11 They must be silenced, because they are ruining whole households by teaching things they ought not to teach—and that for the sake of dishonest gain. *All Bible quotes shall be from the NIV Bible unless otherwise specified.*

² References to all works of art, tombs, tunnels, and architecture in Rome are entirely factual (as are their exact locations). They can still be seen today. The brotherhood of the Illuminati is also factual. Dan Brown, *Angels and Demons* (New York, NY: Atria Books, 2003), Author's Note.

³ In 2003, Sony acquired the movie rights to *Angels & Demons* along with *The Da Vinci Code* in a deal with author Dan Brown. In May 2006, following the film release of *The Da Vinci Code*, Sony hired screenwriter Akiva Goldsman, who wrote the film adaptation of *The Da Vinci Code*, to adapt *Angels and Demons*. On April 11, 2007 it was revealed

Instead, of contradicting the biblical truth about Jesus *not* having a wife and several other facts mentioned in my previous article, *Brown's Inquest, The Da Vinci Code, Fact or Fiction?*,⁴ Brown here challenges the making of *creation!* Brown attempts to show us that God is so weak, frail, and so un-sovereign, that a mere man can invent the great cosmos we see before us. Moreover, he states we can now somewhat believe the Bible because science says it is ok! If it is proven by science, then by all means believe. We will get to this shortly, but for now let us look briefly, at why we may need to be wary concerning what we read.

Hedonism

The world loves entertainment. In the hedonistic society in which we live, we are always looking for the next thrill ride, the next rollercoaster of adventure, anything to take our minds off what and who we really are – *a fallen people*. Hedonism is the philosophy that pleasure is the most important pursuit in life. The name derives from the Greek word for “delight” (*hēdonismos*). Have not we all submitted to it at some time in our lives? I have.

Worldly pleasure may differ from biblical pleasure. While all worldly pleasure is not sinful (reading some secular books, etc.), much of it lies within the deception of the lust of the flesh, the lust of the eyes, and the pride of life (1 John 2:16). This is prevalent in our society today. As one of my dear departed professors, Harold O.J. Brown (*not related to Dan Brown*), stated in his especially good work entitled, *The Sensate Culture*, “The arts reflect the fundamental orientation of society as well as the particular views and behavior patterns of its members; at the same time, they spread and reinforce such views and patterns.”⁵ Indeed, works such as *Angel's and Demons* and others like them are a clock telling the time(s) of our culture. Moreover, like the coliseums in Rome use to murder Christians for sport, so literature is attempting to remove the life of God in the saint under the guise of “pleasure” and “entertainment” – hedonistic literary murder. These are strong words, but the onward Christian soldier must be on his guard.

The Bible reveals to us that the most important pursuit in life is not “pleasure” – at least not *sinful worldly* pleasure. There is however biblical pleasure. The *Westminster Shorter*

that Tom Hanks would reprise his role as Robert Langdon and that he will reportedly receive the highest salary ever for an actor, though this is not confirmed. Filming was originally to begin in February 2008 for a release in December 2008, but because of the 2007 Writers Guild of America strike, production was pushed back for a May 15, 2009 release. Wikipedia, Last Accessed 17 January 2008. http://en.wikipedia.org/wiki/Angels_and_Demons

⁴ Joseph Nally. [Reformed Perspectives Magazine](#), Volume 8, Number 22, May 28 to June 3, 2006. Last Accessed January 2008. http://thirdmill.org/newfiles/jos_nally/PT.jos_nally.da_Vinci.html

⁵ Harold O.J. Brown, *The Sensate Culture, Western Civilization Between Chaos and Transformation*, (Dallas: Word Publishing: 1996), p. 25.

Catechism summarizes the biblical teaching most concisely and elegantly stating that, “Man's chief end is to glorify God, and to enjoy Him forever.”⁶ As the scripture states, in Psalm 73:25-26:

Whom have I in heaven but you? And earth has nothing I desire besides you. My flesh and my heart may fail, but God is the strength of my heart and my portion forever.

The Christian's and the world's greatest pleasure is to be his enjoyment of God –and those things God allows us to enjoy for his glory. He is our portion, he is our pleasure. How? We discover true pleasure in first being converted by God's grace alone and then in doing the things God has so richly displayed to us in his holy word to do.

However, today, many Christians are incorrectly seeking pleasure in all the wrong places. Sinful worldly pleasure has sought to rest not only in our culture through the arts, but in our practice of religion, ethics, law, how we interact with society, education, medicine, and in every other arena of life. Many no longer keep the sabbath⁷ holy. Many attend church and the movies on the same day. They state they are resting – but they ignore that God requires a “holy rest” (Gen. 2:1-3) as shown to us in his creation. However, as seen above, the Christian not only violates this principle on what is supposed to be the most holy of days of the week, but in their normalcy of life as well. This is not without repercussions. O.J. Brown states:

According to the account in Genesis, which has parallels in the myths, legends, and folktales of several cultures, God promised Noah that he would never again destroy the earth by a flood. He did not guarantee, however, that humans would never do something worse to themselves. We are not confronted with literal rising waters as in the deluge but with a rising tide of changes, problems, and trends, any one of which carried to its logical conclusion might engulf us and make human life on earth either altogether impossible or at least no longer worth living.⁸

Hedonism is prevalent in our culture because of our individual depravity. We are fallen from birth (Psa. 51:5). No man naturally seeks after God and his ways (Isa. 55:8-9). Paul reveals this further in Romans 3:10-18 saying:

As it is written: “There is no one righteous, not even one; there is no one who understands, no one who seeks God. All have turned away, they have together become worthless; there is no one who does good, not even one.” “Their throats are open graves; their tongues practice deceit.” “The poison of vipers is on their lips.” “Their mouths are full of cursing and bitterness.” “Their feet are swift to shed blood; ruin and misery mark their

⁶ *Westminster Shorter Catechism*, Q1, A1.

⁷ I refer to the New Testament Sabbath – Sunday.

⁸ *The Sensate Culture*, p. 207.

ways, and the way of peace they do not know.” “There is no fear of God before their eyes.”

Mankind is not merely sick, but *dead* in trespasses and sin (Eph. 2:1). Man is dead to the things of God. Again, as Apostle reminds us in Romans 8:6-8:

The mind of sinful man is death, but the mind controlled by the Spirit is life and peace; the sinful mind is hostile to God. It does not submit to God's law, nor can it do so. Those controlled by the sinful nature cannot please God.

Thus, the deadness we witness in society and its arts is the very deadness within our very souls!

Even after God alone regenerates one, and translates “us into the kingdom of his dear Son” (Col. 1:13), a struggle for the mind and character of the Christian exist.⁹ Paul advises us *not* to conform any longer to the pattern of this world, but be transformed by the renewing of our minds, so we will be able to test and approve what God's will is—his good, pleasing and perfect will (Rom. 12:2). Our minds need to be continually renewed (Col. 3:1-2, 10), not negatively by a sinful worldly culture (1 Pet. 1:14; 1 John 2:15), but by his word, Spirit, and graces (Eph. 4:23; 5:17). Every area of life wars against the Christian. It desires only an inch, so it may drag the saint one more mile from God.¹⁰

Does this mean that the Christian is not suppose to ever go to the movies? May it never be! Yes, the law of God exists, but it does not say, “Thou shall not attend a movie or read a book, or” John Frame writes in, “Should Christians Go to Movies?”

I would conclude, therefore, that a moderate amount of movie-going is legitimate for most Christians. I don't think we should be ashamed of that or even ashamed of enjoying it. Moderation, of course, requires careful thought about priorities. Even activities which are good in themselves can become wrong if they crowd out of our lives things which are more important. Each of us needs to do some self-examination in this area. Choices about exposure to entertainment and culture are not religiously neutral. But those who are conscientious about pleasing God and keeping his commandments need not feel guilty about moderate movie attendance.¹¹

⁹ If Satan cannot have, God's elect, because they are heaven bound, he will most assuredly attempt to have them while they are upon this earth (1 Pet. 5:8). Nevertheless, God will yet preserve them (Rom. 8:25-29; Phil. 1:6).

¹⁰ This will not affect the Christian's eternal security, but it will affect his relationship with his Savior.

¹¹ John Frame, “Should Christians Go to Movies,” *IIIM Magazine Online*, Volume 4, Number 18, May 6 to May 12, 2002.

There are some good books and movies, etc. However, we have been duped into a lie, if we think all culture, in and of itself, has progressed to where there is no sin in *any* movie and that we may attend anything (XXX, etc.) anytime we wish! Many have digressed, to such a state that they think they need – worldly pleasure – and are warranted so on a *continual* basis. Like Israel that wondered in the wilderness, society today wonders from *The Da Vinci Code* to *Angel's* to *Demons* and from the newest CD to the newest DVD or Blu-ray Disc. However, the cautious saint will recognize that there are differences in “types of” and the “frequency of” the type of entertainment they should seek.

Do I attend an occasional movie? Yes. Do I attend an occasional play? I can, but that is not my cup of tea. Do I read books? Yes, but not every book, because I deem some unprofitable for the ministry and my very soul. However, in every book and movie I seek to attend I must also be aware of the false social and theological currents contained in them.

Thus, the Christian community needs to take a moment – maybe a long moment – and examine themselves (2 Cor. 13:5). We need to ask ourselves are we meekly living in the moment to God's glory (1 Cor. 10:31), or are we living for the rollercoaster ride of the moment. God's highway or hedonism?¹² We need grace to make our decision sure.

Heresy

Dan Brown is an excellent writer and has now mastered his literary approach. He simply takes an issue that may be debated in theological circles and writes a mystery around it. His ability to write a mystery is unsurpassed by many, including myself. However, the underlying currents of his writing reveals that he takes some truth and mixes it with some false philosophical reasoning. Reader beware.

Since the movie has not yet been produced, I will briefly discuss the book. I will comment in one concise paragraph on some of his inaccuracies (the Appendix takes care of this in a more detailed manner) and how they diverge from reality. However, my major focus in this article is Brown's “creation” of a new world and how it attacks Christianity – for an attack upon creation is an attack upon its Creator – the Lord Jesus Christ!

A list of many problems in *Angels and Demons* is in the Appendix (I and II) of this article. The types of inaccuracies range from historical, local, religious, scientific, technological, and translation errors. However, the theological errors are so numerous

¹² See Johannes G. Vos' article entitled, “The Bible Doctrine of the Separated Life” for a proper view of books, movies, etc. *Reformed Perspectives Magazine*, Volume 10, Number 20, May 11 to May 17 2008. http://thirdmill.org/newfiles/joh_vos/joh_vos.Separated.Life.html

that if only a couple are overlooked it will give one a false view of not only God's word, but culture, history, and science, itself. Reader beware.

While the inaccuracies of Brown's work should *not* go unnoticed (and some have been corrected in later editions of his work), his idea of creation is a direct attack upon Scripture. The Bible presents the truthful event of an *ex nihilo*¹³ creation – creation from nothing. God spoke and there the materials of the earth were (Gen. 1-2). He shaped what we now see (and the way it was then and the way it will in the future) for his own glory and purpose. The Psalmist writes, "May the glory of the LORD endure forever; may the LORD rejoice in his works" (Psa. 104:31). This is not a feeble prayer that the Psalmist merely hopes will come true, but one he knows without a doubt is true. This is confirmed by John Piper who writes in response to the question, "Does God take pleasure in his creation?" saying:

This is not a prayer for something that might not happen. The psalmist does not mean: "O, I hope God will rejoice in His works, but I am not sure He will." If that were the meaning then the first line of the verse would have to have the same sense: "O, I hope God's glory will endure forever, but I am not sure it will."

That is surely not what He means. The rock solid confidence of the whole Bible is that the glory of the Lord will not only endure forever but that it will cover the whole earth like the waters cover the sea (Numbers 14:21; Habakkuk 2:14).

The psalmist is not praying that an uncertainty might come to pass. He's exulting in a certainty that will come to pass. There is no doubt behind the shout, "May the glory of the Lord endure forever!" And there is no doubt behind the shout: "May the Lord rejoice in His works!"

[Therefore,] the answer to the first question is YES! God does take pleasure in His creation. He delights in the work of His hands.¹⁴

God created the universe and all that is therein in six literal days.¹⁵ God chose six days for a holy purpose. God is sovereign and omnipotent and could have created the world instantly – in less than a micro-second (Gen. 1:1). However, in his wisdom, God choose stress a six-day creation and one day of rest for an example for those, he created in his image on the sixth day – mankind. As Douglas Kelly writes:

¹³ See, Paul Copan and William Lane Craig, *Creation Out of Nothing, A Biblical, Philosophical, and Scientific Exploration*, (Grand Rapids, MI: Baker Academic, 2004).

¹⁴ John Piper, "The Pleasure of God in His Creation." Last accessed 17 January 2008. <http://www.climbingforchrist.org/Default.aspx?tabid=2100>

¹⁵ There are other views within Christianity such as the Frame-work view, etc.

Is it not more concordant with the patent sense of the context of Genesis 2 (and Exodus 20) to infer that because the Sabbath differed in quality (though not – from anything we can learn from the text itself – in quantity), a slightly different concluding formula was appended to indicate a qualitative difference (six days of work; one day involved rest)? The “And on the seventh day God ended His work which He had made; and He rested on the seventh day from all His work which He had made’ (Gen. 2:2) seems by the normal rules of biblical interpretation to intend an end just as definite as that of ‘and the evening and the morning were the first day.’ This is the more compelling as we recall the purpose of God’s having taken six days to work and one to rest: to provide an orderly, life sustaining pattern for His image bearers.¹⁶

Kelly above brings out in his defense of a literal 6 day/24 hour day creation.¹⁷ That is: (1) God is the creator of the earth in six literal days, and (2) God rests in the seventh day not because he is tired, but as an example to his image bearers of how they shall now live. Thus, as we see, God is glorified in his making of creation as it serves the multiple purposes for which he designed it. All things are for his glory (1 Cor. 10:31).

On the other hand, Dan Brown reduces the miraculous to a mere scientific experiment. There is no rest for the weary in discerning truth from error for those that read his invention (Psa. 106:29; 39). In a crucial scene, one of the world’s leading physicists is astonished to hear that another physicist has created matter from energy, because that is creating something from nothing (see Appendix II).¹⁸ If this is so, then you can create something from nothing then the creation story in the Bible *might* be scientifically reasonable, and *maybe* we can unify science and religion. This is a major premise in his book.

There are more than a few errors in Brown’s fiction that is challenging to Christian worldview. I will point out only two.

First, the true Christian does not need the evidence of the ever-changing field of science for his faith to be true. This is actuality a direct contradiction of what faith truly is. As the writer of Hebrews states, “Now faith is being sure of what we hope for and ***certain of***

¹⁶ *Creation and Change*, p. 111.

¹⁷ Specifically against Hugh Ross’ idea of old earth in *Creation and Time* (Colorado Springs, CO: NavPress, 1994).

¹⁸ He proved not only that matter can be created from nothing, but that the Big Bang and Genesis can be explained simply by accepting the presence of an enormous source of energy. “You mean God?”Kohler demanded. “God, Buddha, The Force, Yahweh, the secularity, the unicity point—call it whatever you like—the result is the same. Science and religion support the same truth—pure *energy* is the father of creation.” When Kohler finally spoke, his voice was somber. “Vittoria, you have me at a loss. It sounds like you’re telling me your father created matter...out of nothing?” “Yes.” Dan Brown, p. 72.

what we do not see. This is what the ancients were commended for” (Heb. 11:1-2). True faith is established in God’s word – and may be apart from science. True faith says, “I believe” no matter what science, or other philosophies may say. One believes in God despite what others think or even think they have proven.

Christians have a God-given presupposition that God and his word exist and are true! The, I AM that I AM (Ex. 3:14) ingrains in his elect that HE IS because HE IS (Job 19:25; John 17:3; Rom. 8:9-11, 15-16; Eph. 1:13-14; Heb. 11:6). On the other hand, Dan Brown mixes some truth with some error, some pure water with some poison and presents it as truth and wholly drinkable. However, poison is destructive and deadly – not pure.

While science may confirm what Christians already believe, we should not believe just because science, archeology and other philosophies may say something is correct. This is taking the word of man over the word of God. This is *not* faith in God and his inerrant word, but man’s discoveries and/or inventions. This is *not* to say that scientists should not explore the universe and see what makes it tick. However, what science discovers must be compared and interpreted by a more sure word of testimony – the Scripture.

The Christian community needs to be reminded of this. As Peter writes 2 Peter 1:12-21:

So I will always remind you of these things, even though you know them and are firmly established in the truth you now have. I think it is right to refresh your memory as long as I live in the tent of this body, because I know that I will soon put it aside, as our Lord Jesus Christ has made clear to me. And I will make every effort to see that after my departure you will always be able to remember these things. **We did not follow cleverly invented stories** when we told you about the power and coming of our Lord Jesus Christ, but we were eyewitnesses of his majesty. For he received honor and glory from God the Father when the voice came to him from the Majestic Glory, saying, "This is my Son, whom I love; with him I am well pleased." We ourselves heard this voice that came from heaven when we were with him on the sacred mountain. **And we have the word of the prophets made more certain**, and you will do well to pay attention to it, as to a light shining in a dark place, until the day dawns and the morning star rises in your hearts. Above all, you must understand that no prophecy of Scripture came about by the prophet's own interpretation. For prophecy never had its origin in the will of man, but men spoke from God as they were carried along by the Holy Spirit.

While one will readily admit that this set of verses has to do with the revelation of Christ’s inauguration of the Kingdom in his birth, life, death, resurrection, and ascension, we must not forget that his first coming upon the earth in word and Person was as its Creator (Col. 1:15-17; Heb. 1:1-2). Thus, Moses gives us a more sure word of testimony of creation in Genesis 1-2! Our faith is to remain in God’s word – *not* man’s!

I note, that Peter stated that his audience was already, “firmly established in the truth” and that he and others of Scripture did “not follow cleverly invented stories.” Peter says that the Christian community would “do well to pay attention to it, as to a light shining in a dark place, until the day dawns and the morning star rises in your hearts.” Why? “For prophecy never had its origin in the *will of man*.” Where did it come from then? “Men spoke from God as they were carried along by the Holy Spirit.” Thus, we have a sure word in God’s word, as it is God’s word and there can be none higher!

Can we trust some of what we learn from science and other “general revelation,” as it is interpreted in light of Scripture?¹⁹ Of course, but it does not become the foundation of our faith, but merely a confirmation of the faith that should already be present – of one “firmly established in the truth.” As Greg Bahnsen writes, “Scripture has authority to declare what has happened in history and to interpret it correctly.”²⁰ Therefore, the *reason* found in science needs to be built upon faith, or man is in danger of setting himself up as his own god – a god which changes with every scientific discovery and error.

The Bible makes it possible for us to understand nature. In God's word, we find his *special* revelation, which is always faithful. As God's nature never changes

¹⁹ It has become apparent that the big bang has theistic implications. In the wake of the emergence of big bang cosmology as the prevailing scientific model. Robert Jastrow of NASA’s Goddard Institute has observed the remarkable concurrence between Scripture and science:

Now we see how the astronomical evidence leads to a biblical view of the origin of the world. The details differ, but the essential elements in the astronomical and biblical accounts of Genesis are the same: the chain of events leading to man commenced suddenly and sharply at a definite moment in time, in a flash of light and energy.

He goes on to admit:

For the scientist who has lived by his faith in the power of reason, the story ends like a bad dream. He has scaled the mountains of ignorance; he is about to conquer the highest peak; as he pulls himself over the final rock, he is greeted by a band of theologians who have been sitting there for centuries.

Robert Jastrow, *God and the Astronomers*, (New York: W. W. Norton, 1978) , p.14. As quoted by, Paul Copan and William Lane Craig in *Creation Out of Nothing, A Biblical, Philosophical, and Scientific Exploration*, (Grand Rapids, MI: Baker Academic, 2004), p. 17.

²⁰ Greg Bahnsen, *Always Ready, Directions for Defending the Faith*, (Nacogdoches, TX: Covenant Media Foundation, 2000), p. 79.

neither does the truth of his word.²¹ We read in the *Westminster Confession of Faith* that:

The authority of the Holy Scripture, for which it ought to be believed, and obeyed, dependeth not upon the testimony of any man, or church; but wholly upon God (who is truth itself) the author thereof: and therefore it is to be received, because it is the Word of God The supreme judge by which all controversies of religion are to be determined, and all decrees of councils, opinions of ancient writers, doctrines of men, and private spirits, are to be examined, and in whose sentence we are to rest, can be no other but the Holy Spirit speaking in the Scripture (1.4, 10).

Thus, one must beware of the underlying current of Dan Brown's novel. If I may be so bold, we need to beware of his 'anti-matter in his matter.'²² Christianity and *all* science do not need to agree so one may believe the Bible. God exists. God's inerrant word exists and is true. The Holy Spirit lives in the believer. Thus, as a believer is enabled to walk in truth, he has been enabled to believe the old adage, "I know, that I know, that I know." However, this is not a blind faith. His faith contains reason grounded in faith. Besides the Bible, he may look at the complexity of the universe, chemistry, biology, the human body, and all creation and can say with the Psalmist, "I praise you because I am fearfully and wonderfully made; your works are wonderful, I know that full well" (Psa. 139:14). More importantly, he may with reason look at the multitude of biblical and historical evidences for the life, death, and resurrection of Christ and say with certainty – He lives!

Second, Brown's argument, "from energy" is not at all like, "from nothing." As previously explained, God created an *ex nihilo* creation – from nothing. God did not begin with pure energy, anti-matter, or particle accelerator. God spoke and matter (and anti-matter, space, and time) came into existence! Before matter was, God is.

Far from an *ex nihilo* creation in Brown's assessment of creation he created "in time" that already is. In Brown's universe time already was/is. In addition, space – the space where his experiment took place – already existed. Moreover, he used existing matter: a tunnel 27 kilometers in circumference,²³ a reversed polarity vacuum,²⁴ magnetic field,²⁵

²¹ While, neither *general* nor *special* revelation should be taken without regard for the other, with only *general* revelation to show us the way, we would be left in the darkness of sin, confusion, and our own depravity.

²² Langdon felt awkward, not sure what this had to do with anything. "Um, God created...light and dark, heaven and hell—"Exactly," Victoria said. "He created everything in opposites."Vittoria nodded. And when my father ran his experiment, sure enough, two kinds of matter appeared." – matter and anti-matter. Brown, p. 73.

²³ LHC, "Large Hadron Collider said. "A particle accelerator.".... "This tunnel is twenty-seven kilometers long?..." Brown, pp. 54-57.

²⁴ Brown, p. 75.

canisters,²⁶ et. al. – to create his man-made universe. Far from Brown's physics ever coming close to confirming, much-less joining the truth, his fictional science merely proves that there must be a more intelligent Designer²⁷ than he, as Brown's creation lacks a created space and time for matter (and anti-matter) to even to have been existent!

Therefore, the Christian reader should *use caution* in reading *Angels and Demons*, for in places it is *nilho* in truth and certain things need to be *ex'd* out!

I hope the reader will not look upon my comments as directed towards Brown himself, but about what Brown has written from a philosophical viewpoint. As for Brown himself; if he was one day converted what his artful pen could do for cause of Christianity is beyond my imagination. Though presently misdirected, he has a true skill to write. The prayer of the Christian community needs to be that one day God will place Dan Brown upon his knees to ask Christ into his life (Acts 9:1-17). If and until then his works contain some 'anti-matter' – that is, not filled with God's truth.

²⁵ *ibid.*

²⁶ *Ibid.*

²⁷ See William A. Dembski's book entitled, *Intelligent Design, The Bridge Between Science and Theology* (Downers Grove, IL: IVP, 1999).

Appendix I²⁸

Wikibooks describes the books “divergence from reality,” saying:

In the beginning of the book, Brown claims that “references to all works of art, tombs, tunnels, and architecture in Rome are entirely factual (as are their exact locations). They can still be seen today. The brotherhood of the Illuminati is also factual.” While the book does not specifically say that all of its apparently factual statements are true, Brown’s assertions regarding his extensive research have led some readers to take the fictional universe of the book to be congruent to reality. However, in many ways the fictional universe of the book’s storyline significantly diverges from reality.

Historical Divergences

- Langdon asserts incorrectly that Michelangelo designed the outfits for the Swiss Guards, though this is a common misconception. According to its official site, Commandant Jules Repond (1910-1921) designed the uniforms influenced by the Renaissance artist Raphael.
- In a flashback, Langdon recalls a lecture he gave in his *Symbology 212* class where he tells his class that “The practice of ‘god-eating’ — that is, Holy Communion — was borrowed from the Aztecs.” It’s unclear how this could have occurred, as communion has its roots in the Last Supper (ca. AD 30) and the Aztec culture did not rise until the 14th century. Even if the Aztecs had been around when the practice of communion began, there is no evidence of contact between Europeans and the inhabitants of Central America at that time. The first clear evidence of European contact with these people occurred after Christopher Columbus reached the New World in 1492.
- Brown states that Winston Churchill was a Roman Catholic. Churchill was a non-observant member of the Church of England. He was not a “pillar of the church” but a “flying buttress”. “I support it from the outside.”
- Langdon recalls “that much of Galileo’s legal trouble had begun when he described planetary motion as elliptical. The Vatican exalted the perfection of the circle and insisted that heavenly motion must be only circular.” In reality Galileo famously refused to believe in his friend Kepler’s elliptical orbits and Galileo’s clash with the Vatican was a result of his support for Heliocentrism, that is claiming that the Earth orbited the Sun and not vice versa.
- Brown mentions in a dialogue between Langdon and Kohler that Copernicus was ‘murdered by the church for revealing scientific truths’. Copernicus, as a matter of

²⁸ Wikibooks. *Angels and Demons/Divergence from Reality*. (no authors listed). Last Accessed 17 January 2008. http://en.wikibooks.org/wiki/Angels_and_Demons/Divergence_from_reality. While one may not agree with this total list, the one feature this list brings to light is the error in this supposed inerrant work. In addition, the book's first edition contained notably numerous errors of location of places in Rome, as well as incorrect uses of Italian language. Some of the language issues were corrected in the following editions.

'fact'(a word which has been used rather loosely by Brown himself), was a Polish priest and was encouraged by other clergymen to publish his findings. He died a natural death, and there is no evidence suggesting that he was murdered. For more details, readers are referred to Arthur Koestler's book *The Sleepwalkers (A History of Man's Changing Vision of the Universe)*.

<http://www.amazon.com/exec/obidos/tg/detail/-/0140192468?v=glance>

- The Hashshashin hired by the novel's villains refers to Christians as playing a critical role in the downfall of his sect. This is inaccurate; the Hashshashin were crippled by invading Mongols when their fortress of Alamut in modern-day Iran was destroyed in 1256.
- There is no such publication as the *British Tattler*. *The Tatler*, note the spelling, is well known and would not be described as such by BBC employees who are clearly having some sort of national identity crisis in their conversations.
- Brown states that the Isola Tiberina was thought to have healing powers ever since 1656. However, already the people of ancient Rome built a temple to Aesculapius, the Greek god of healing, on the island in the third century BC.

Location Divergences

- CERN does not have a private airport or any aeroplanes especially an X-33 spaceplane. In fact, the X-33 was only produced as a subscale technology demonstrator and was never actually built full-scale.
- Dan Brown claims that "Bernini's city-wide cross of obelisks marked the fortress in perfect Illuminati fashion; the cross's central arm passed directly through the center of the castle's bridge, dividing it into two equal halves." In fact, neither of the two arms of the cross go through the Castel Sant'Angelo. In all likelihood, Brown was using a topographical tourist map to design this plot element and had not realised that the physical layout was different (and such a map would not have been in print for the designers of the city).
- While in the church of Santa Maria del Popolo, Langdon thinks, "Renaissance cathedrals invariably contained multiple chapels, huge cathedrals like Notre Dame having dozens." This leads the reader to believe that the architecture of the Notre Dame cathedral in Paris is of the Renaissance period. In fact, Notre Dame is the most famous example of Gothic architecture in the world, which predates the Renaissance period.
- The St.Peter church's crypt (*Grotte Vaticane*), where most Popes are entombed, is open to the public.

Religious Divergences

- Brown claims that hatha yoga was an ancient Buddhist art. Although influenced by Buddhism, hatha yoga predates Buddhism. It was, and is, a Hindu art.
- In examining the body of the previous Pope, the Swiss Guard simply slide back the marble top of the tomb and they check the tongue of the Pope. In fact, Popes are buried in three (3) nested coffins, which would have made this task somewhat more difficult.

- The novel asserts several non-facts about the process of a Papal conclave. It is suggested that only cardinals may be elected in a conclave. This is not true, any male Roman Catholic may be elected. It is further suggested that four candidates are semi-formally chosen, including a head, to become the candidates for papacy, thus making the Conclave obsolete. This is again not true, though there are papabile, they are not practical definites before the beginning of the conclave. Further, ballots are restricted to two in the morning and two in the evening, each group is burned together. Dan Brown indicates they are burned individually and indicates that more than two may occur in a single evening. The ballots are read out by one cardinal, verified by another, and pierced by a third; the book suggests that a single person does all of these. Brown gives the role of camerlengo to the late Pope's secretary. The camerlengo does organize the Conclave but he is never the pope's secretary. In fact, the camerlengo is a member of the College of Cardinals. The late Pope's secretary has no authority over anyone in the Vatican, as he loses his job when the pope dies. Also, the book states that the "Dean of the College of Cardinals" of the conclave cannot be elected; in fact, he can, and he actually was in the 2005 conclave. It also should be noted that the Devil's Advocate has nothing to do with the papal election (but with the process of beatification). Langdon's encounters with the camerlengo Ventresca take place in the Papal Apartments, while in fact the rules order that the apartments be sealed during the Conclave and the late Pope's staff has to live somewhere else.
- Concerning Cardinal (Kardinal) Ebner from Frankfurt (the first victim): There are two major cities in Germany that are called Frankfurt (in addition to small one(s)): Frankfurt am Main and Frankfurt an der Oder. None of them are one of Germany's dioceses and therefore none of the Frankfurts have a bishop. It is not a necessity to be a bishop in order to be chosen to become a cardinal, but that is of course with absolute majority the case. In Germany, there are two theologians who became cardinals (the rest were bishops): Alois Kardinal Grillmeier and Leo Kardinal Scheffczyk. So theoretically, it is possible that there is someone from Frankfurt who was chosen to become a cardinal. But more likely is that Dan Brown made a rather common mistake: Frankfurt am Main has a big church in its center called "Dom" (cathedral). A cathedral (German: "Dom" or "Kathedrale") is the central church of a diocese and the bishop's seat. Therefore, it is not uncommon that people think Frankfurt is a diocese and has a bishop. But in this case the term "Dom" was used as a general description of a large and historically important church. The name of the Frankfurt Dom is "St. Bartholomäus" (Bartholomew) (see: Kaiserdom St. Bartholomäus). Everyone refers to that church though as "Dom" or "Kaiserdom" (Emperor's Cathedral), because from 1562 to 1792 ten German emperors were coronated in that church. Strictly speaking though the use of the word "Dom" is wrong. A list of the real Dome/Cathedrals in Germany can be found at: [List of Cathedrals ~](#)
- Cardinal's habits are not black as those of ordinary priests, but red.
- Brown refers to the Biblical Book of Judges as the Book of Judgments.

Scientific Divergences

- The proton is not, as stated in the book, the antiparticle of the electron. The proton is the antiparticle of the antiproton; the electron is the antiparticle of the positron.
- Brown writes that the antimatter canister will detonate with the energy of a 5 kiloton bomb. However, the energy released will be from the total consumption of 0.5g of material; 0.25g of antimatter, and 0.25g of normal matter. This has the energy equivalent of about 10^{13} Joules, or about 10 kilotons of TNT. The Hiroshima bomb was about 20 kilotons. The Nagasaki bomb was 13 kilotons.
- Containment of hydrogen (anti- or otherwise) in a magnetic field would not be possible in a small portable container. For the hydrogen to form a droplet at normal temperatures and in a vacuum (as would be necessary to isolate it from normal matter) would require a magnetic field of extraordinary strength, beyond the power of a portable power source. This magnetic field would have to extend well beyond the canister and would cause vigorous effects on ferromagnetic materials nearby. Furthermore, hydrogen in its conventional liquid state is diamagnetic, and would be difficult to suspend unless the compression induced by the magnetic field caused the hydrogen to become metallic (as in the core of gas giant planets).
- Having jumped out of a helicopter seconds before a ten kiloton antimatter annihilation, Mr Langdon would most likely have been vaporised. If not, then the explosion would have propelled him at such a speed that there would be absolutely no chance of his slowing enough to land safely.
- Annihilation of protons and antiprotons would generate energy primarily in the form of 900 MeV gamma rays. These gamma rays would easily penetrate the matter surrounding the bomb and deliver a lethal dose of radiation to any exposed person standing closer than 2-3 km from the point of explosion.
- The process of creating antimatter described in the book is inaccurate. Instead of colliding two particles moving in opposite directions, CERN smashes protons into a stationary block of copper or iridium.
- It is impossible to create and sustain the densities of antimatter described in the book. Similarly, antimatter could never be used as a source of power. Antimatter has to be created since it is found nowhere on Earth naturally. The amount of energy required to operate the particle accelerator would be far greater than (or, ideally, equal to) the energy the antimatter-matter reaction would produce. Of course, it could well be that Leonardo Vetra's supposed breakthroughs in antimatter technology have transcended these boundaries.
- Near the end of the novel, Brown repeats the popular notion that humans only use a small percentage of their brains. In fact, this is a myth.

Technological Divergences

- The pilot explains Langdon's nausea is altitude sickness from flying at 60,000ft. Many Concorde passengers flew at 60,000ft without experiencing altitude sickness.
- It is impossible yet to create a device that would measure the charge remaining in a battery so accurately, that it could show the time remaining to battery exhaust with the precision of 1 second.
- Rather than being the mature transport system described in the book, the Lockheed Martin X-33 is, in fact, a small unmanned technology-demonstration vehicle. Intercontinental hypersonic spaceplanes are planned, but none exist.
- Arguably the most blatant and central error made in the book concerns the wireless camera which occupies a central role in the search for the antimatter canister. In the book, the canister is supposedly being filmed by a wireless camera and that signal is being displayed on a large screen in St. Peter's square. In order to find this camera, the Swiss Guard needs to shut off every electronic device to and conduct a painstaking search for the camera, which is eventually found, with the canister, deep underground in a labyrinth of tombs beneath the Vatican. There are several problems with this plot line.

First, if the wireless camera's signal is being received and the picture displayed in St. Peter's Square, then it would not take more than a few minutes for a trained team of engineers to triangulate the position of the transmission. Indeed, consider the countless movies about World War II clandestine radio operators who could not transmit more than a few minutes at a time so as not to be detected by the counter-intelligence triangulation teams. Here we have a camera that is transmitting for *hours*. The rule is: if you can receive the signal, it is very easy to find out where it comes from. The other, second and perhaps greater error is the fact that this wireless camera is transmitting from underground. Transmission of a video signal takes a lot a bandwidth and hence must have a relatively high carrier frequency (such as VHF, UHF, or SHF). In the book, we are told that we can see the canister's display counting down in *seconds* in real-time, which means that we are indeed talking about a relatively high bandwidth signal, and hence, the assumption of a high carrier frequency is a good one. Such carrier frequencies cannot penetrate any significant obstacles and hence it is simply impossible for the signal of such a camera to be received if it were transmitting from deep underground. Indeed, it would be virtually impossible to receive a signal from deep underground even if a very low frequency carrier were to have been used. In conclusion, the whole premise of the plot, namely a laborious search for a canister which is being filmed by a wireless camera from deep underground, does not stand the scrutiny of basic radio transmission principles.

- The author appears to confuse the invention of the World Wide Web by Tim Berners-Lee at CERN in the 1980's with the invention of the Internet mainly in the US in the 1960's. Far from being unrecognised for his work as is implied in the book Tim Berners-Lee has received numerous awards including appointment

to the Order of the British Empire as a Knight Commander (KBE). He is also head of the W3C which manages and creates the standards which underly the web and are used by all software makers as the basis for their web-related products.

- Cellular phones do not have dial tones.
- “Illuminati: New World Order”, the game mentioned in the book, is a Collectible card game, not a computer game. Steve Jackson Games is not a computer game company. It is not playable on the internet, and one does not score points by killing opponents.

Translation Errors

- Langdon states at one point that the phrase *Novus Ordo Seclorum*, found on American currency, translates as “New Secular Order.” The correct translation is “New Order of the Ages.”
- Almost all of the Italian quotations are grammatically and linguistically incorrect e.g. “Spazzare di cappella” would be similar to saying “to sweep of chapel”, instead of perhaps “*controllare la cappella*”, meaning “check the chapel”

Appendix II²⁹

Dan Brown's book *Angels and Demons* is a detective story about a secret society that wants to destroy the Vatican using an antimatter bomb. In the book, the antimatter is stolen from CERN.

Readers have asked us even more questions about the technologies used in the story. Here are our answers.

Does CERN exist?

Well, yes, it does. You can see us to the left and slightly up from the centre of the city of Meyrin.

Is it located in Switzerland?

Part is in Switzerland, part in France across the border. CERN is not a Swiss institute, but an international organization. We are very close to Geneva's intercontinental airport.

What does the acronym CERN mean?

That is a long story.

Does it consist of red brick buildings with white-frosted scientists running around carrying files?

No, that is rather far from reality: we have mostly white buildings made of concrete and the scientists wear everyday clothes and they mostly do not carry files.

Was the web really invented at CERN as the book states?

Yes, indeed, the web came from CERN, invented here by Tim Berners-Lee in 1989.

Does antimatter exist?

Yes, it does, and we make it routinely at CERN. Antimatter was predicted by P.A.M.

²⁹ CERN, the *European Organization for Nuclear Research*, is one of the world's largest and most respected centres for scientific research. Its business is fundamental physics, finding out what the Universe is made of and how it works. At CERN, the world's largest and most complex scientific instruments are used to study the basic constituents of matter — the fundamental particles. By studying what happens when these particles collide, physicists learn about the laws of Nature. Last accessed 17 January 2008. <http://public.web.cern.ch/Public/en/Spotlight/SpotlightAandD-en.html>

Dirac's theory of quantum mechanics in 1928 and antiparticles were found soon after by Carl Anderson. CERN is not the only research institute to produce and study antimatter.

How is antimatter contained?

With very great difficulty. It annihilates completely when it touches any normal matter. There are two cases:

Case 1: If an antiparticle is electrically neutral then electric and magnetic fields have no hold on it at all. Therefore, there is no easy way to contain neutral antimatter particles, i.e. no way to keep them away from the normal-matter walls of the vessel in which they are. They therefore almost immediately come into contact with normal matter and annihilate.

Case 2: For electrically charged antimatter particles such as positrons (antielectrons) and antiprotons we know how to use "electromagnetic bottles" to contain them. However: like charges repel each other. So it is not possible to put a large quantity of antiprotons together because the repulsive forces between them soon become too strong for the fields that hold them away from the walls. And you cannot put a mixture of positive antielectrons and negative antiprotons together, because they will make antihydrogen, which is neutral and we are in case 1 again.

So only very minute quantities can be contained.

What are the future uses of antimatter?

Antielectrons, or positrons, are already used in PET scanners in medicine (Positron-Emission Tomography = PET).

Other uses are in studying the laws of nature, as we do at CERN. The team of the PS210 experiment at the Low Energy Antiproton Ring (LEAR) at CERN made the first antihydrogen atoms in 1995. Then, in 2002 experiments managed to produce tens of thousands of antihydrogen atoms, a sufficient number to study this gas in its antimatter form. However, although 'tens of thousands' may sound a lot, it's really a very very small amount. You would need 10 000 000 000 000 000 000 times that amount to have enough antihydrogen gas to fill a toy balloon! If we could somehow store our daily production, it would take us 25 000 000 billion years to fill the balloon. The universe has only been around for 13.7 billion years... So the *Angels and Demons* scenario is pure fiction.

Can we hope to use antimatter as a source of energy? Do you feel antimatter could power vehicles in the future, or would it just be used for major power sources?

There is no possibility to use antimatter as energy 'source'. Unlike solar energy, coal or

oil, antimatter does not occur in nature: we have to make every particle at the expense of much more energy than it can give back during annihilation.

You might imagine antimatter as a possible temporary storage medium for energy, much like you store electricity in rechargeable batteries. The process of charging the battery is reversible with relatively small loss. Still, it takes more energy to charge the battery than what you get back out of it. For antimatter the loss factors are so enormous that it will never be practical.

If we could assemble all the antimatter we've ever made at CERN and annihilate it with matter, we would have enough energy to light a single electric light bulb for a few minutes.

I was hoping antimatter would be the future answer to our energy needs. It seems more research is needed for this to happen.

No, the true answer is that it will never happen simply because of the entropy problem. Creating antimatter out of energy via $E=mc^2$ unfortunately always produces equal amounts of normal matter and antimatter. This is fundamentally built into the universe. For any given amount E of energy you will get $m/2$ grams of antimatter and $m/2$ grams of matter. Putting these two amounts back together and annihilating them gives back E . But the process is not without loss: today the loss is enormous, but even if we could make the process very efficient, we would still not have any net gain!

It is not a matter of "more research" or "more advanced technology" to find ways around these limitations. Antimatter is a fundamental state of matter. It could only become a source of energy if you happened to find a large amount of antimatter lying around somewhere (e.g. in a distant galaxy), in the same way we find oil and oxygen lying around on Earth. But as far as we can see (billions of light years), the universe is entirely made of normal matter and antimatter has to be painstakingly created.

This by the way shows that the symmetry between matter and antimatter as stated above does not hold at very high energies, such as shortly after the Big Bang, since otherwise there should be as much matter as antimatter in the Universe. These energies are higher than any that can be achieved on Earth at present; what future research might tell us is how this asymmetry came about, although it is extremely unlikely to lead to the possibility of using antimatter as an energy source.

Can we make antimatter bombs?

There is no possibility to make antimatter bombs for the same reason you cannot use it to store energy: we can't accumulate enough of it at high enough density.

Sociological note: scientists realised that the atom bomb was a real possibility many years before one was actually built and exploded, and then the public was totally surprised and amazed. The antimatter bomb on the other hand has been imagined by the public who wants to know more about it, yet we have known for a very long time that it's not at all a practical device...

Why has antimatter received no media attention?

It has received a lot of media attention, though usually in the scientific press. Also, antimatter is not 'new': we've been using it for decades; antimatter has been observed for almost a hundred years.

Is antimatter truly 100% efficient?

Depends what you mean by efficient. If you start from two equal quantities $m/2$ of matter and $m/2$ of antimatter, then you get exactly $E=mc^2$ as energy out. Of course. It converts at 100%.

But that is not the point: how much effort do you have to put in to get $m/2$ grams of antimatter? Well, theoretically $E=mc^2$ because half of the energy will become normal matter. So you gain nothing. But the process of creating antimatter is highly inefficient: when you make antimatter particles, a lot of them go astray before you can catch them. Everything happens at nearly the speed of light, and the particles created zoom off in all directions. Somewhat like cooking food over a campfire: most of the heat is lost and does not go into the cooking of the food, it disappears as radiation into the dark night sky. Very inefficient.

In fact we have to use hundreds of times more energy to create the matter/antimatter pairs than the theoretical minimum of mc^2 , but we won't ever get back more than mc^2 .

Do you make antimatter as described in the book?

No. The production and storage of antimatter at CERN is not at all as described in the book: you cannot stand next to the Large Hadron Collider (LHC) and see it come out, especially since the LHC accelerator is not yet in operation. To make antiprotons we collide protons with a block of tungsten (Wolfram). Out of this come a large number of particles, some of which are antiprotons. Only the antiprotons are useful, and only those that fly out in the right direction. So that's where your energy loss goes: it is like trying to water a pot of flowers but you only have a sprinkler that sprays over the whole garden. Of course, we constantly apply new tricks to become more efficient at collecting antiparticles, but at the level of elementary particles this is extremely difficult and sometimes impossible.

Why then do you build the LHC?

The reason for building the LHC accelerator is not to make antimatter but to produce concentrations of energy high enough to study effects that will help us understand some of the remaining questions in physics. We say concentrations, because we are not talking about huge amounts of energy but enormous concentration. The energy in each particle that we will accelerate in the LHC is equivalent to the amount of energy in a flying mosquito. Not much at all in absolute terms, but it will be concentrated in a very

minute space and inside that minute space things will resemble the state of the universe close to the Big Bang.

You should compare the concentration effect to what people can learn about the quality of a wooden floor by walking over it. If a large man wearing normal shoes and a petite woman wearing sharp stiletto heels walk over the same floor, the man will not make dents, but the woman, despite her lower weight, may leave marks: the pressure created at the stiletto heels is far higher. So that's like what the LHC will do: concentrate little energy into a very minute space to make a huge concentration effect and learn something about the Big Bang.

Does CERN have a particle accelerator 27 miles long?

The LHC accelerator is a ring of 27 kilometers in circumference. The LHC is in a tunnel about 100 m underground. You can see the round outline of it marked on a map of the area.

In fact, why do you make antimatter at CERN?

The principal reason is to study the laws of Nature. The current physics theories predict a number of effects, and many of the effects concern antimatter. If experiments do not observe the predictions, then the theory is not accurate and needs to be amended or reworked. This is how science progresses.

Another reason is to get extremely high energy densities in collisions of matter and antimatter particles, since they annihilate completely when they meet. From this annihilation energy other interesting particles may be created (this was mainly how the Large Electron Positron collider operated).

How is energy extracted from antimatter?

When a normal matter particle hits an antimatter particle, they mutually annihilate into a very concentrated burst of pure energy, from which in turn particles are created. These new particles can be matter particles or energy particles (photons), depending on a number of factors, with an obvious constraint that the total incoming energy is exactly equal to the outgoing energy. Almost all of it ends up as heat. Not very useful.

How safe is antimatter?

Perfectly safe, given the minute quantities we can make. It would be very dangerous if we could make a few grams of it, but we can't.

If so, does CERN have protocols to keep the public safe?

There is no danger from antimatter. There are of course other dangers on the CERN site, as in any laboratory: high voltage power in certain areas, deep pits to fall in, etc.

but for these dangers the usual industrial safety measures are of course put in place. There is no radioactive leak danger for the public as you might find around nuclear power stations. There is even no indirect danger such as from thermal power stations and oil consumption which produce longer term pollution and global warming.

Does one gram of antimatter contain the energy of a twenty kiloton nuclear bomb?

A “kiloton” in this context means a thousand tons of TNT explosive. Twenty kilotons was the equivalent of the atom bomb that destroyed Hiroshima.

The question is somewhat confusing: you are probably talking about the explosive release of energy by the sudden annihilation of one gram of antimatter. Let’s calculate it. A “kiloton of TNT” is not a metric unit, it corresponds to 4.2×10^{12} joules. A 60 watt light bulb consumes 60 joules of energy per second. The notation 10^{12} means a 1 followed by 12 zeros:

$$1'000 = \text{kilo} = 10^3 \quad 1'000'000 = \text{mega} = 10^6 \quad 1'000'000'000 = \text{giga} = 10^9 \\ 1'000'000'000'000 = \text{tera} = 10^{12}$$

So a kiloton is 4.2 terajoules or 4.2 TJ. A gram is 0.001 kg. The speed of light is 300'000 km/s or 300'000'000 meter/s. Now $E=mc^2$ so for 1 gram we get $E= 0.001 \times 300'000'000 \times 300'000'000 \text{ kgm}^2/\text{s}^2 = 90'000'000'000'000 \text{ J}$ or 9×10^{13} joules or 90×10^{12} J or 90 TJ. If 4.2 TJ corresponds to a kiloton of TNT, then 90 TJ corresponds to $90/4.2 = 21.4$ kiloton. About right.

But for the antimatter bomb we are actually talking about two grams: one gram of antimatter, annihilating with one gram of normal matter, and therefore you would release twice that amount! You need only half a gram of antimatter to be equally destructive as the Hiroshima bomb, the half gram of normal matter is easy enough to find.

At CERN we make quantities of the order of 10^7 antiprotons per second and there are 6×10^{23} of them in a single gram of antihydrogen. You can easily calculate how long we would have to work to get one gram if we could make the 10^7 antiparticles every second: we would need $6 \times 10^{(23-7)} = 6 \times 10^{16}$ seconds. There are only $365 \times 24 \times 60 \times 60 = 3 \times 10^7$ seconds in a year, so it would roughly take $6 \times 10^{16} / 3 \times 10^7 = 2 \times 10^9$ or about two billion years! Of course, it would be utterly impossible to contain this amount of pure negative electric charge.

Did CERN scientists actually invent the internet?

No. The internet was originally based on work done by Louis Pouzin in France, taken up by Vint Cerf and Bob Kahn in the US in the 1970's. The web however was invented and developed entirely by Tim Berners-Lee and a small team at CERN during 1989-1994. The story of the Internet and the Web can be read in “How the Web was born”. Perhaps

not as sexy as *Angels and Demons*, but everything in “How the Web was born” was first-hand testimony and research.

Does CERN own an X-33 spaceplane?

No.

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