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The Small Book of Big Thoughts

PSEUDOSCIENCE

Fringe or Fraud?

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June 2017

"Alternative" Science

Is that like "alternative facts"?

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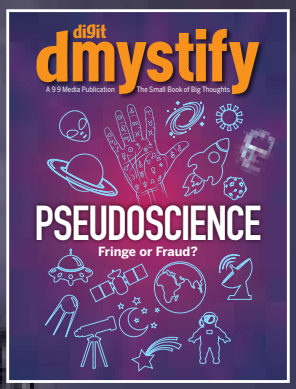
INSIDE



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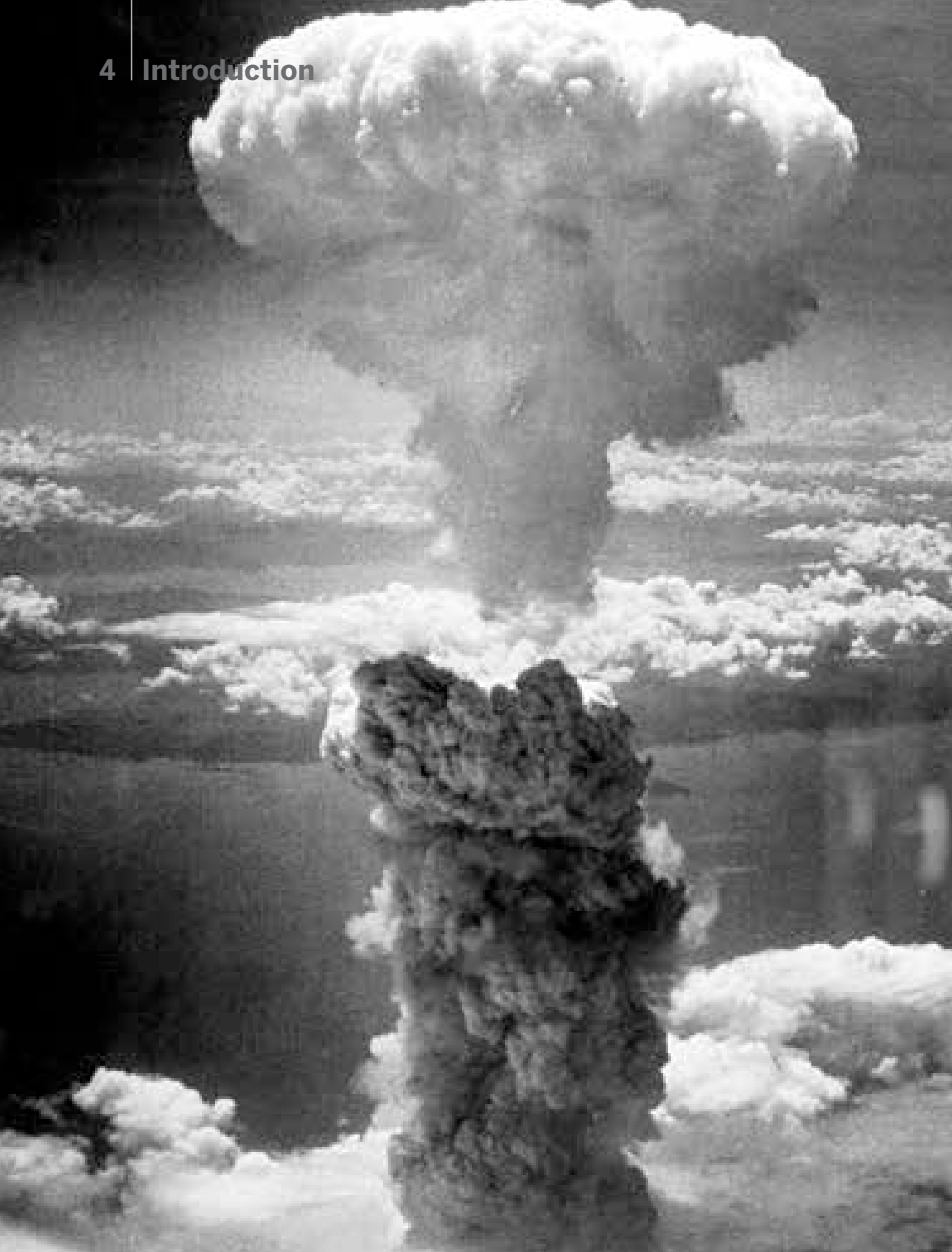


Runs and hides

It had to come to this at some point. You cannot advocate and promote science literacy and not take on the debate between science and pseudoscience. Many of us hold a lot of these so-called pseudosciences close to heart – especially in our country. India, after all, has originated a lot of what is considered fringe science or even pseudoscience.

We have no doubt that this book will ruffle a few feathers, and perhaps even irritate some of you. Heck, we think that we might even irritate the science followers amongst you because we're going to attempt to put our own biases away and keep an open mind.

The only thing we will not do is give up the scientific method of putting things to the test, because as far as we are concerned, that's the very bedrock of logic and modern knowledge. We're not going to give any credence to personal anecdotes or stuff you think a friend-of-a-friend witnessed, or anything like that. Claims which are not repeatable, testable and verifiable are just not scientific claims, and that is the basis of calling an idea or theory "pseudoscience". We're not writing them off as hogwash, but merely stating that they're not "science", so please don't burn our office down! ■

Pseudoscience

What are they, and could they be science?

The word "pseudoscience" is in itself, really, a mishmash of Greek and Latin. Obviously "science" has a Latin origin ("scientia", meaning "knowledge"), but "pseudo" comes from Greek, and means "fake", or "false". It was (probably) first used by physiologists in the 19th century (1800s) with regards to medicine, as that is the area that was (and still is) the most plagued by pseudoscience

This mish-mashed word is perhaps ideal in that regard to describe the various topics that we will touch upon in this book.

Again, just in case this book offends you, remember that we're only informing you about something that "isn't science" or is a "false science", and hoping that you will take the time to read both sides of the argument before jumping to any conclusions.

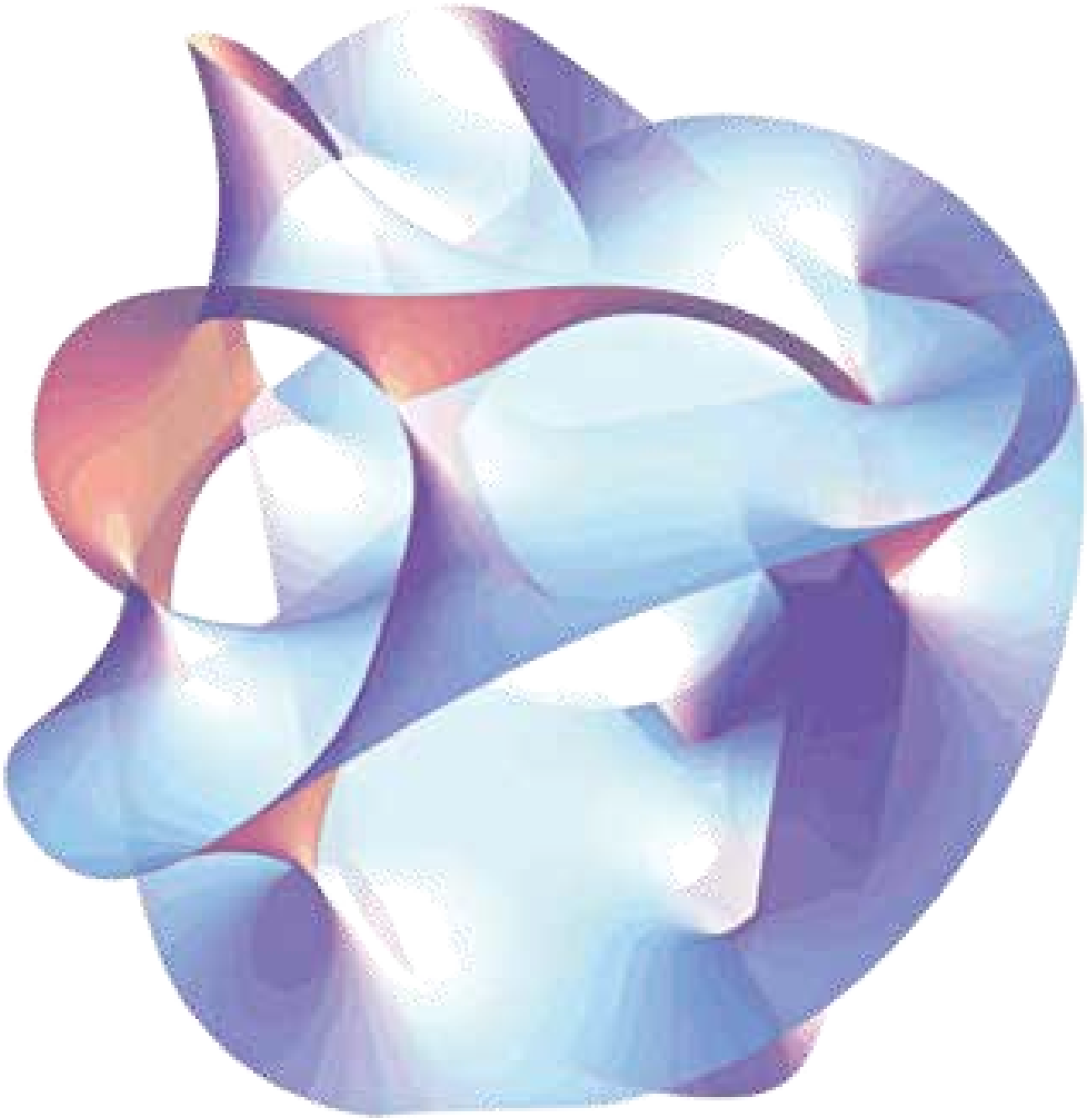
If you dislike your beliefs being challenged. Please stop reading this book NOW. Please consider yourself warned, as we will now take off the kid gloves, and any hurt you feel will be purely self-inflicted.

Science

To begin with, any area of real scientific study has to be segregated into experimental or theoretical. For example, in Physics you could choose to be an aerospace engineer or a theoretical physicist. Now, some would say theoretical physics is more mathematics than it is physics, and they'd be right, but we're just illustrating a point here, so get off our case.

Basically, in order to be able to send rockets into space, you will need real world physics knowledge, and perhaps have an engineering frame of mind – test every little change and think of everything possible. However, in order to think about parallel universes, you need complex math to prove that they are a possibility, but it is all theoretical until and unless we devise a way to prove that they exist, or don't.

There is of course a big difference between fringe science and pseudoscience, although the differentiation might not always be apparent to the public. For example, a lot of "fringe science" is eventually recognised as science later on. The perfect example is continental drift (which we've covered in previous dmystify books), because the idea of the land itself moving was too ridiculous to be accepted at one point. Sadly, it's also because of such fringe science (which is first rejected unanimously, then partly accepted and eventually fully accepted) that a lot of pseudoscience earns credibility.



We can't test String Theory, but at least it is supported by mathematical models

Just because plate tectonics (fringe science) was eventually found to be true, doesn't mean that astrology (pseudoscience) will also eventually found to be true. Total rejection by the scientific community cannot be used as a benchmark for arriving at the truth. What is important, instead, is to look at the method being used to arrive at the hypothesis, and how it can be tested.

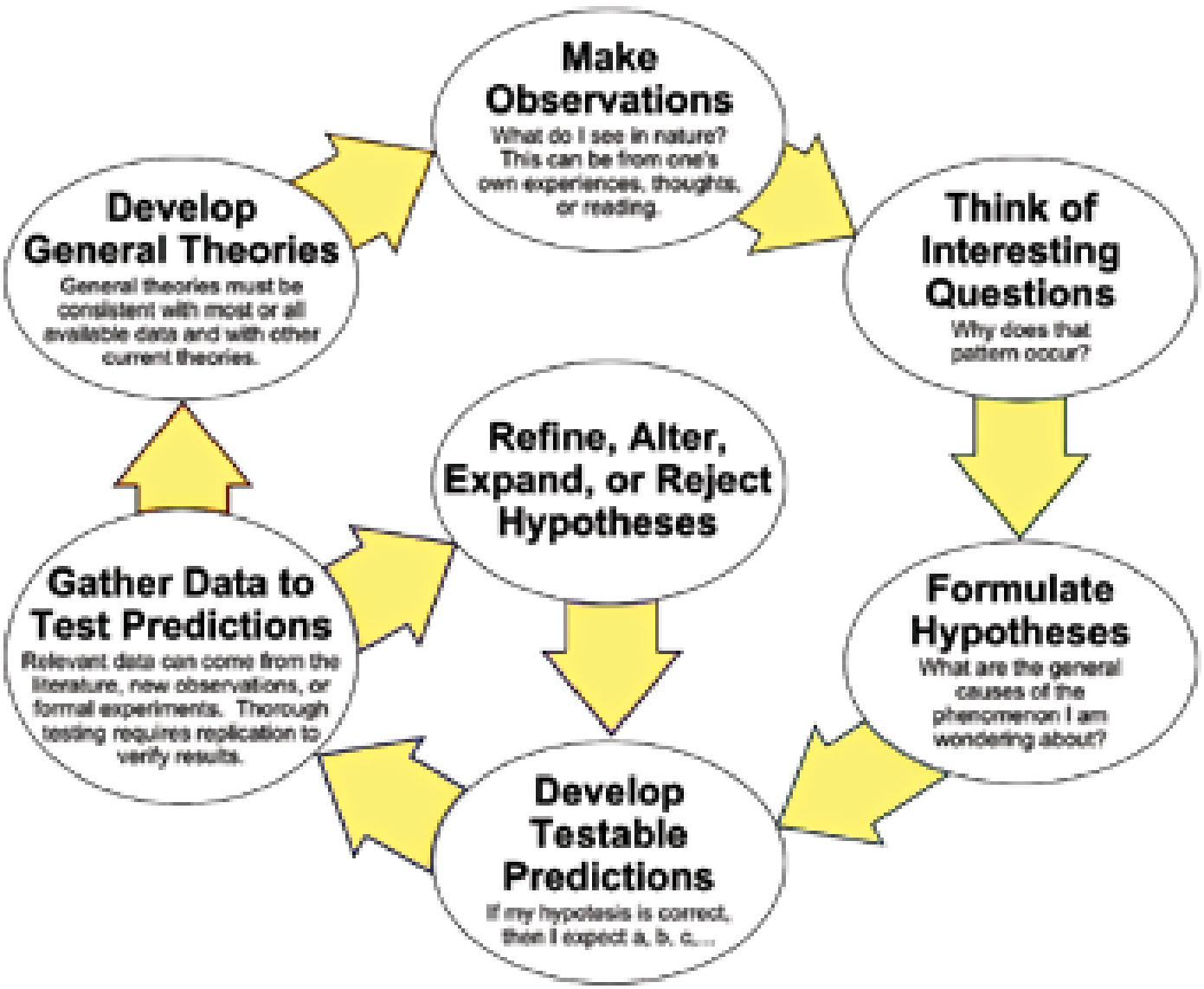
Also, it's important to remember that a lot of fringe science that later became science, such as the Big Bang theory, or heliocentrism (Sun at the centre of the solar system, as opposed to geocentrism – earth at the centre) were rejected when science was still developing itself, and our collective knowledge was pretty limited as compared to the technology-assisted, libraries-full-of, knowledge that we have now.

The biggest distinction between fringe science and pseudoscience is that the former uses the scientific method.

Scientific method

Given all of the possible physical "evidence" we are able to find all over the planet and our solar system, and all of the readings we are now able to take of things at not just the quantum scale, but also at the scale of distant galaxies, we obviously need a way to interpret and qualify evidence. This is where the scientific method comes in.

The Scientific Method as an Ongoing Process



The scientific method

What it is, is basically simple rules that all scientists have to use when collecting data and especially when planning an experiment, or when formulating a hypothesis.

The scientific method requires that all experiments be testable, repeatable, verifiable, and that theories make predictions that are falsifiable.

One way of looking at science is to assume that the scientific method dictates that all scientific study be in the form of rational questions to which answers can be sought using physical evidence. Let's take a look at an oversimplified example as a way of illustrating this.

Thus, a question that says "Why does it rain?" can be broken down into little testable and repeatable parts which are questions that perhaps someone else might have already answered, and whose answers were peer reviewed and accepted to be true. For example, while researching "Why does it rain" you might first want to know the three natural states of water (solid, liquid and gas) and how they behave. This might be something someone else has already answered. Next, you might want to know about the earth's atmosphere, and how it behaves – does it get hotter or colder the higher we go up in the atmosphere? Does it get denser or rarer? The answers to these questions are also already answered. Mostly through experiments and have thus been directly observed. Next, you might want

to take the common occurrence of rain and study the situations in which it happens. You might find that there are a few common things that always happen when it rains, one of which is the fact that the sky is always cloudy and overcast. In fact, not just clouds need to be present, but darker clouds seem to bring more rain than lighter clouds, and the whitest clouds often bring no rain. Again, this might be an investigation already undertaken, or if it is ongoing then you would call them up and offer to collaborate or at least share findings. There would be a hundred such things you would have to consider before you came up for a "theory" about "Why does it rain?".

We can see clouds drop rain now

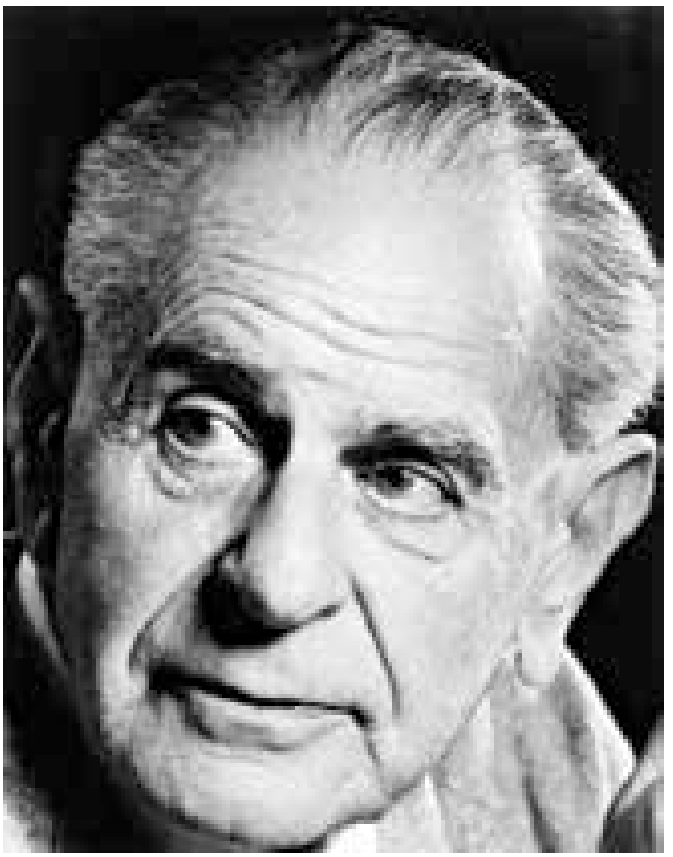
Of course, this "theory" is nothing but an answer to the question we had asked in the beginning of the experiment, but it is based purely on evidence and doesn't suffer from confirmation bias (sticking to the answer you like, and looking for only the answers you like). Advances in each theory are celebrated.

For example, if you worked hard to do this, and arrived at an answer about rain being water vapour in the atmosphere which condenses and then falls to the earth, and if it was a breakthrough for the time, you would win a Nobel prize. A couple of years later another scientist would come along and further that by saying not only does the amount of water vapour in the air matter, but also atmospheric low and high pressure systems, and of course the general climate. This scientist has now come up with a much better and (pardon the pun) watertight explanation for the same phenomenon called rain, but no one will be calling you to demand the Nobel prize back. She might win a Nobel prize herself, and both you and her will forever go down in history as the people who were the first to properly explained rain. The theory of rain will be updated, and science moves on to the next unanswered question... this is the scientific method.

Pseudoscientific method

Generally, when you come across a pseudoscience, you will find that it is either easily falsifiable, but makes excuses for not using the

scientific method, or else, you will find that it isn't falsifiable at all, which many would argue, would amount to you not even asking a scientific question.



Karl Popper

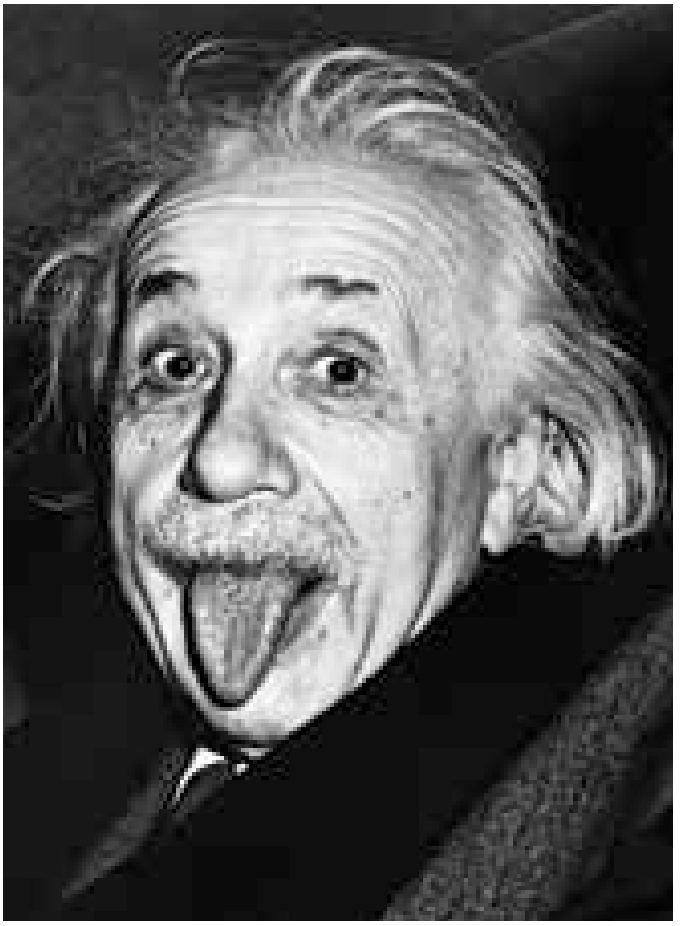
It was Karl Popper, an Austrian-British philosopher who came up with the idea of what is truly science and what isn't. Living in an exciting time (early 1900s), Popper grew up reading about the findings of two famous people – Albert Einstein and Sigmund Freud. He even met Einstein and attended some lectures by him. It was the stark difference between the fields of psychology and physics and the theories that Einstein and Freud were coming up with that made the biggest impression on Popper. He went on to form the field of Philosophy of Science, which even today works hard to arrive at the true meaning of science, what it can reveal, what are its effects and of course, what are the truths we discover, and whether they really are truths to begin with.

Popper's criticism of Freud and his methodology was mainly to do with the fact that psychology wasn't making any predictions that were "risky" and falsifiable. He felt that for something to be considered science, all solutions and theories it came up with had to be falsifiable. For example, Einstein waited for a solar eclipse with bated breath (it was 98 years since that day on May 29). This was because he had made a prediction using general relativity about the effects of gravity on light. This is because Einstein considered space and time to be relative, and thus gravity bent the four dimensional realm he called spacetime. What Einstein had done with general relativity was predict that Newtonian physics was in fact wrong, and that his theory was a better fit. The astronomer Sir Frank Watson Dyson devised an experiment in 1917 to prove or disprove Einstein's prediction, by using an upcoming total solar eclipse. The experiment would involve comparing the expected position of stars to the observed position when they're behind the sun. Now, of course, this meant observing stars in the daytime, which is impossible, except, of course, during a total solar eclipse. Because a major total solar eclipse was scheduled for May 29, 1919, and the Hyades star cluster would be at the right position just above the sun (light from Hyades still visible but also passing through the gravitational influence of our sun), the experiment was planned. Sir Arthur Eddington was the one who led the experiment.

Sir Arthur Stanley Eddington

He sent off astronomers to Brazil and himself went to the West African island of Príncipe to observe the solar eclipse. For months they took readings of the Hyades star cluster to determine the "true" positions expected, and then when the eclipse occurred, they both measured the observed position, which was altered because of the sun's gravity. Of course it took months for them to gather the data (remember, there were no flights back then), and then to analyse it all, and on November 6, 1919 they announced that Einstein

was indeed correct. This is what catapulted Einstein to global fame.



THBBPTHBPT! – I was right!

Coming back to Popper, he felt that it was this type of prediction (one that could have killed off Einstein's theory of general relativity for good had he been wrong) that "real" science made. He contrasted this to Freud's methodology of using data to arrive at a theory, to which more data could be added, and almost all data could be made to fit a narrative (torturing of stats to get a desired answer). This is why he described pseudoscience as something that wasn't falsifiable. Although his interpretation of what is science isn't considered valid anymore today, his description of pseudoscience is still pretty relevant...

Anyway, enough of the buildup, let's get to the actual suspects now... ■

Medicine

Do these really cure anything?

We're starting here because this is where you will find most of the pseudosciences that are still popular today. Sadly, this is also the aspect of our lives where pseudoscience can do the most damage, and even cause deaths, which is why it's something we have to tackle. It is also the section of this topic that will probably upset most people, because it is in the field of medicinal pseudosciences that most people put their trust, especially in India. Our apologies in advance, but like ripping off a dressing that's stuck to a wound... we need to do this to prevent further infection...

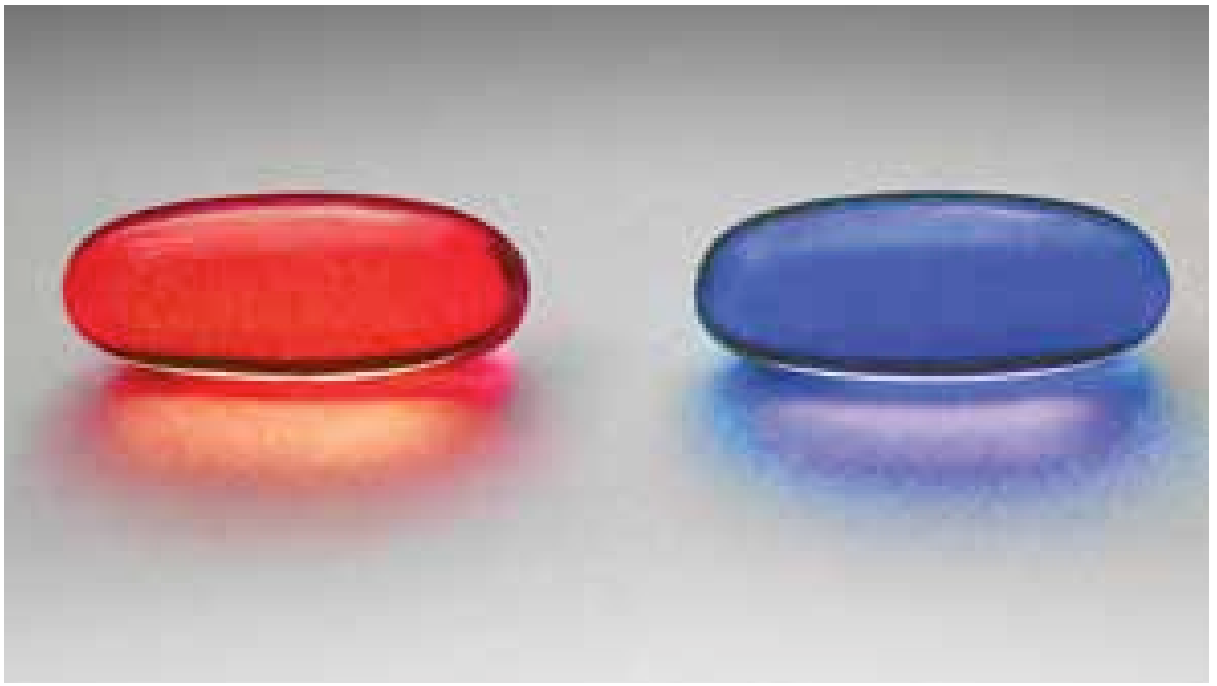
Anti-vaxxers

Despite all our poverty, lack of hygiene and toilets and even our lack of basic necessities for all of our 1.3 billion strong population (food, clothes, water, electricity, roof over the head, etc), the government of India and some very determined NGOs worked together to make India officially polio free back in 2014. The WHO (world health

organisation) is pretty strict when giving that badge to someone, and it means that India went from having the most number of children affected with polio (over 50,000 per year until 1995 when the polio drive was started), to not a single case of virulent polio in the whole of India since 2011.

However, there are increased cases of vaccine-derived polio resurfacing across the globe. Now hang on, don't jump up and down and scream bloody murder like an anti-vaxxer, hear us out first...

The problems with vaccines is that it only works when everyone participates. What the WHO means by vaccine-derived polio doesn't mean that giving your child the vaccine exposes them to polio, it



Pseudoscience is like taking the blue pill

means that giving a child the vaccine exposes an anti-vaxxer's kids to polio! Actually it's more likely that a poor person who didn't attend the polio drive and get the free vaccine is exposed to the virus. The oral vaccine for polio works by injecting a weakened dose of the virus so that your body builds up immunity to it, so that if it comes in contact with the wild virus it will be able to fight it. The vaccine virus stays active in the intestine for up to two weeks in a child, and is excreted along with bowel movements (poo). In unsanitary conditions, this virus can be transmitted via infected water to another child. If the child is vaccinated themselves, there's no danger, but if the child isn't vaccinated, then polio may develop.

Now the problem is that media houses don't understand the science and write reports about such announcements, and scare the general public who are usually ignorant of the facts. This is exactly what happened with "vaccine derived polio infections". Anti-vaxxers promptly started sharing the news as if the vaccines themselves were dangerous, and many stopped giving their children vaccines. Not only did they misunderstand the news, they deliberately put their own children at more risk than normal, all because of a stupid belief. Just remember, if you hear of a vaccine derived infection of polio in your city, encourage everyone to vaccinate, as that's the only way to wipe polio out. Currently, the wild polio virus is holed up in Afghanistan and Pakistan. If there was some way to vaccinate everyone in those

two countries, the world could be rid of the polio virus forever, and the world could stop administering polio vaccines for good!

A second and very well-known case that caused a lot of hype in the media was because of a fraud called Andrew Wakefield, who was conducting research to see if there was any link between autism and the MMR vaccine. His study found that there was a link, however, investigation into him and his study showed that he had many financial investments that would benefit from breaking the public's trust

Andrew Wakefield lost his license to practice medicine because he manipulated evidence

in the MMR (measles, mumps and rubella) vaccine, and also found that he invented many of the results of his study. Basically, Wakefield had manipulated evidence to establish a connection where there was none. Several studies were undertaken after him, and all of them proved no link between autism and the MMR vaccine whatsoever. Of course, being the lovers of conspiracy theories that we are, the hoax was widespread pretty soon, and to this day, is considered to be the most damaging medical hoax of the last century!

Wakefield then attempted to get support from celebrities with autistic children, and convinced Robert De Niro (who has an autistic son) to allow him to show a documentary called Vaxxed (directed by Wakefield) at the Tribeca Film Festival. Thankfully De Niro met some real scientists before this could happen and was shown the real evidence which disproved Wakefield's claims. As expected the movie still managed to find a way to distribute itself after this, but launch day viewing was reportedly merely in the dozens, thankfully.

This writer also has a child with autism, and totally understands the feelings of parents looking to assign blame to something for their child's differences and difficult life ahead. A vaccine is a faceless thing we can assign blame to, and assigning blame often makes pain easier to bear. However, by playing a part in spreading a hoax, we are essentially sacrificing hundreds or even thousands of little children across the globe who will die from perfectly preventable diseases, only because

their parents buy into the anti-vaxxer hoax, and don't vaccinate their kids. What those of us with autistic children really need to ask ourselves is whether we're willing to take responsibility for the death of other's children, just because we want to feel better by accepting a pseudo-scientific claim? This writer chooses not to, and hopes those of you who happen to have an autistic child will do the same.

Homeopathy

From diluted and deactivated viruses we move on to severely diluted medicine. Perhaps all of us Indians know about homeopathy, and a lot of us probably have used it at some point or another. The Indian government is one of the few governments around the world that officially recognises Homeopathy as a national medicinal system. Some in fact mistakenly believe that homeopathy has Indian origins, which of course is untrue.

Homeopathy was started in 1796 by German physician Samuel Hahnemann, who believed in a doctrine that like cures like. The idea is that if a substance causes a similar effect in the body as a disease, it can also cure that disease.

Don't be confused by the apparent similarities between vaccinations and homeopathy, because there are none. Vaccinations use dead or inactive cells of the disease itself to build immunity, while homeopathy tries to cure symptoms, for all practical pur-

poses, by using extremely diluted substances that might cause those symptoms.

Thus, if substance X causes fever and chills when taken in a large dose, and a certain type of viral infection causes a fever with chills, the homeopath will try and cure the fever and chills by giving you a very diluted dose of substance X. How diluted? Apparently the more diluted the better.

Scientific studies have shown homeopathy to be no better than a placebo effect, and this means homeopathy is essentially just you popping sugar pills. However, we're sure many of you will disagree, and that's OK. Your personal beliefs, or ours, for that matter, are not what makes something science, and is the reason why homeopathy is strictly pseudoscience.

Traditional medicine

This would include the Chinese traditional medicines such as acupuncture, acupressure, Qi, etc., Indian practices such as ayurveda, Siddha and Unani, Japanese medicinal techniques such as Kampo (which is still really Chinese traditional medicine), and various other superstitions from various cultures across the globe.

To be fair, many of the medicines prescribed by ancient doctors was actually beneficial to some extent, and was painstakingly arrived at by trial and error, and the knowledge passed down from one

generation of doctor to another. Of course, modern medicine is considered better by science, because only the beneficial ingredients are retained and the rest omitted. However, this is not always the case...

Many scientific medical studies that have been conducted all seem to point to all ancient traditional medicine techniques being either nothing more than placebos, or at best mild forms of modern medicine. Although they were pathbreaking and life saving in their time, their time has passed.

Some of the ingredients used in Chinese traditional medicine

Taking ayurveda as an example: whilst many of us will continue to swear by it, and our parents would consider it blasphemy to even question ancient Indian wisdom, sadly, when it comes to the scientific world, it's all considered to be pseudoscience. Not only is ayurveda, in many cases, considered to be a placebo, it's actually considered harmful in some scenarios.

For example, a study done in 2008 of 213 ayurveda remedies that were purchased in India or the UK via the internet, found that

A typical ayurveda pharmacy

one fifth of those remedies had considerable amounts of heavy metals (lead, arsenic or mercury). Whilst the levels were far above US levels, some of them had levels that were accepted by the WHO. Obviously more studies need to be conducted in this space to get to the bottom of what's happening. People have claimed to have suffered from heavy metal poisoning from certain ayurvedic products, but it's always been abroad.

Whilst there's no denying that many traditional remedies from all cultures seem to work perfectly in some scenarios, it's honestly a hit or miss affair, which is not something you want from the medical field. It would be best to read all the labels like a hawk, and to do your research before putting anything into your body – modern or ancient!

Chiropractic

While most of us would think that chiropractors are real doctors, chiropractic it is considered pseudoscience by most of the medical profession. It was started by Daniel David Palmer, a Canadian. All we can really say is that he was Canadian, and cannot give him a profession (such as "a Canadian doctor" or "a Canadian scientist") because he had so many... or none... depending on which way you want to take the following information: he grew up in Ontario, and moved to the US in his twenties with his wife, and worked as a grocery store owner. He also tried his hand at teaching at a school,

and was also an apiarist (beekeeper). He practised magnetic healing (another pseudoscience) and eventually started chiropractic. He claimed that he received knowledge of this from "the other world" (wherever that is), and the knowledge was that almost everything that ails the human body is because of the spine and because of vertebral subluxations – misaligned vertebrae.

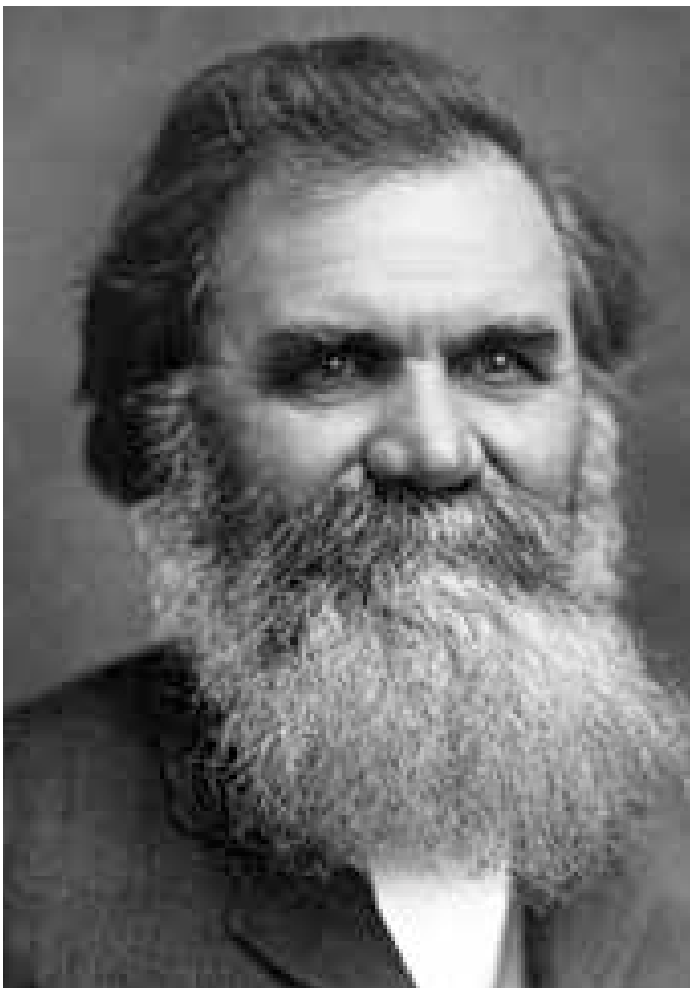


Image credit: Palmer College of Chiropractic

Daniel David Palmer

There is a story he told about meeting a janitor named Harvey Lillard, in 1985 who was almost deaf. Palmer noticed a lump in Lillard's neck, and suggested to him that he had misaligned vertebrae, and that aligning those could cure his hearing. Apparently the treatment worked, which convinced Palmer that every ailment was spine-related. He started a school for chiropractic, and the pseudoscience continues even today. It is

especially popular in the US, Canada, Europe and Australia. Medical associations in those places have suggested that chiropractic courses be removed from public institutions and the career be discouraged as it is considered by real doctors to be quackery.

The (somewhat limited) good news is that chiropractors do appear to be able to help (sometimes) with lower back pain, however, there have also been many cases where a visit to the chiropractor has resulted in death because of severing of a spinal artery in individuals who are predisposed to that condition. Even strokes have been caused, as well as some cases of permanent disability. Studies done using the number of people who had adverse reactions to physical manipulation of bones or vertebrae showed that chiropractors account for almost all of the injuries, whilst osteopaths, physiotherapists and even GPs account for almost none of the manipulation-related injuries.

Although not very popular in India, there are still a smattering of chiropractors to be found, and all we can do is urge you to do your research before you go to them for lower back pain, and certainly consider going to a real specialist for anything other than that.

Colon cleansing

Pardon the pun, but this one is all poo. Literally! The idea behind colon cleansing is that it should be good to clean out your colon.

Seems obvious, because we know that poo is dirty, so why on earth wouldn't you want your colon cleansed?

There are several methods that are used, and whilst some advocate dietary changes and work from your mouth down, most methods go in from the other end. From using plain water, to water with herbs in it and various other liquid concoctions and fragrances, the aim is to cleanse your butt. A tube is put up your butt, and the liquids forced in, and well, the cleanse begins.

The problems with the method (apart from having pipes stuffed up your butt) is that it is based on an incorrect understanding of the way the body functions. The body is perfectly capable of cleansing itself, and the colon especially so. Plus, there is a delicate balance of bacteria in our digestive system, and messing with it is not generally considered very wise by (real) medical experts. Apart from just messing up your body's biota, there's also the risk of colon damage because of those pipes, or the pressure of liquid that is forced in. Plus, there are people who do this too often, and this increases their dependence on these enaemas, which leads to a whole new set of problems... usually, constipation but can also include irritable bowel syndrome and piles – which can really be a pain in the bum! Do yourself a favour, avoid this "therapy" and save your own ass, or else be prepared to become the butt of all jokes. OK, we've officially reached the tail end of all the posterior humour, so let's leave all of this rump talk behind us.

Magic energy healing

This segment includes practices such as reiki, crystal healing, magnet therapy, Qigong, and more. Although the practices may differ a lot, depending on which healing method you're trying out, the most basic common denominator to all of these is that they claim to be able to harness some mysterious energy of the universe and channel it. Whilst no evidence has ever been found of any energy being channelled with any of the techniques we have listed (and even those we haven't listed), this doesn't stop the claims that proponents of each method make.

Probably built upon from the ancient Chinese myths about a life force called Qi (pronounced chi), the idea behind all of these is that the body needs access to magical energy, and channeling it using some sort of medium is the way to fix or heal your body.

In the case of Reiki and other similar pseudosciences another human or their parts are used to focus the energy. Reiki usually involves people touching you and putting their palms on you. The practice was started off by a Japanese Buddhist monk named Mikao Usui in 1922. Clinical tests have proven reiki to be no more effective than a placebo, and in fact often people delay real medical help whilst receiving reiki and this results in worsening of health or unnecessary complications. Although medical professionals aren't particularly bothered to try and tackle reiki because it isn't considered as harmful

Reiki in action

as other pseudosciences, they do urge that it never be used as a substitute for real medicines.

Crystal therapies (and other object-based energy therapies) involve placing special universe energy focussing crystals on a patient's body (usually on special spots that contain our "chakras"). Studies have shown that crystals have no special healing powers,

and the effectiveness is no more than the standard placebo effect. Usually crystals aren't harmful, so there's no real danger to a patient, so long as they don't avoid proper medical care, and don't go broke buying magic crystals.

Magnet therapy is a little different, because magnetism is actually a known force in the universe. However, the premise that magnetic therapy is built on is one that is totally wrong. We all know that our blood contains iron, and is considered iron rich, in fact. And, even a child will tell you that iron is attracted to a magnet. Right? So we put two and two together and get 2002! A child could come up with this theory!

It is true that human blood is very slightly diamagnetic when oxygenated (repelled by a magnetic field), and paramagnetic when deoxygenated (attracted to a magnetic field), but the magnet strength we'd need to have any noticeable effect on blood would be massive – we're talking magnets used in MRI machines. Researchers did this test with a 1.3 tesla magnetic field, and found that when blood flowed in the direction of the field, it reduced in viscosity by up to 30%. Of course magnet therapy proponents went to town with this singular study, with the standard claim of "We told you! We've known for years, and science is only now catching up..." etc. All of it is of course lies, because the trinkets they sell to you are so weak that the magnetic field they output wouldn't even penetrate your

You'd need a magnet this strong acting on only one vein for magnet therapy to work

skin! Plus, they're not even being applied in the direction of blood flow, which is anyway impossible to do as arteries don't follow nice straight lines as the capillaries that the researchers used. However, the amount of magnet therapy junk that was sold to science ignorant

everyday folk using this study was probably prohibitive! The only attractive force is the one between our money and the leeches who sell this junk...

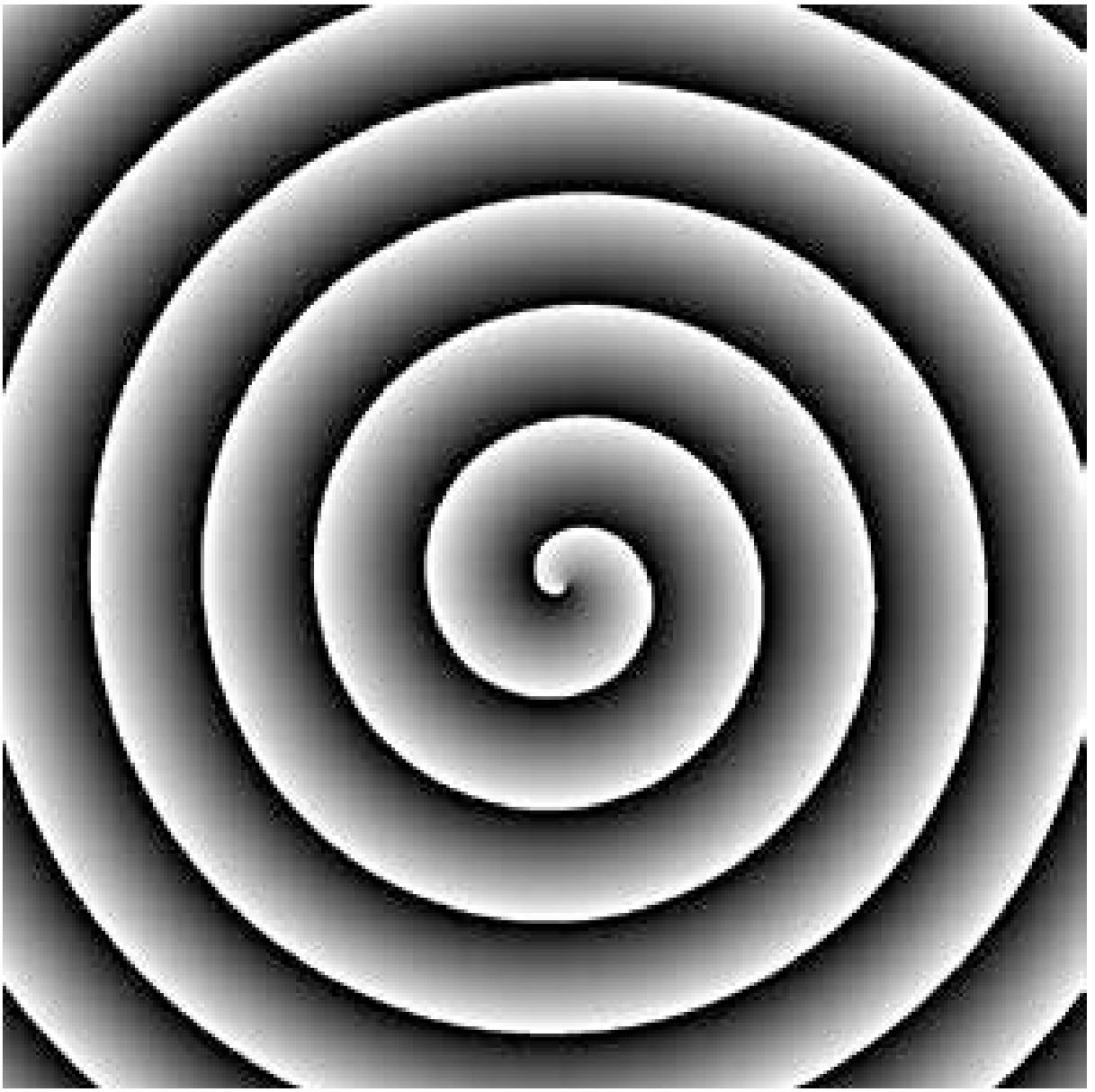
Overall, studies have been done, and none of the secret energy or magnetism therapy claims have any merit. If you're really fond of wasting money, give it away to charity instead of wasting it on any of these...

Hypnosis

You might be surprised to see this here, because we've heard of trained psychiatrists using hypnosis to treat their patients. If real doctors use it, doesn't that make it science? Not quite.

Franz Mesmer (1734 to 1815) was famous German physician who proposed that there was an attraction or energy transfer between all living things and inanimate objects. It's basically more "universe energy" that Mesmer thought could be used to heal people. This force was later called mesmerism, and is also the origin of the word "mesmerise". Originally the word meant to be strongly attracted to, but eventually it donned the more modern day meaning of being unable to look away from...

Étienne Félix d'Henin de Cuvillers was a French scientist who was a follower of Mesmer, and invented the words hypnosis, hypnotist and hypnotic (in their French equivalents) in about 1820. Then, in the



You're getting sleepy!

1840s, Scottish doctor James Braid popularised the terms in English. He called hypnosis a "nervous sleep", because the subject seemed to be sleep walking, and had no recollection of events when they awoke.

The problem with hypnosis is that it doesn't work with everyone, and it's very hard to know whether it is a truly altered state of consciousness (as some claim it is), or merely a subject subconsciously playing along with a role-playing game of sorts.

Recent studies have proven that hypnotised patients can be physically made to feel no pain (or less pain), and that has even been backed up by MRI scans. Many patients have been hypnotised and have reduced the amount of pain medication they take. Some have taken no pain medication after surgery, as they have been successfully hypnotised to feel no pain.

However, the fact that hypnosis works on people and even benefits them says nothing about it being a proper science. The placebo effect, which we have mentioned several times already, is after all a case of the human mind tricking itself into feeling better, and often has very positive results. You could essentially give people sugar pills for some diseases and the patients heal as if they were given real medicines! This still doesn't make sugar pills medicine, does it?

It's perhaps safest to assume that the jury is out on hypnosis. However, verdict has been passed a long time ago on other areas of hypnosis, such as past life regression, and that verdict is woo-woo (aka quackery, or pseudoscience)! Past life regression involves people remembering details about their past lives (which, obviously, assumes reincarnation). This has shown to be people who are already

susceptible to hypnosis responding to questions or suggestions from the person prompting them to invent memories.

Psychology understands and explains how we are able to create and then remember false memories – often experiences much after the event has occurred are able to "colour" our memory of an event. There are cases where multiple people who were at an event have falsely remembered something that never happened. False memories are often exposed by reviewing video footage of past events. An example would be remembering your best friend's wedding, where you saw his/her grandma. A few years later she dies, and you attend her funeral, and see a picture of her at her house with your best friend on his wedding day wearing a blue sari. Many of your friends see this same picture, and for all of them this image is stored. A few months later you all meet up for your friend's wedding anniversary, and you're reminiscing about his grandma, and how she looked so happy and healthy in her blue sari. At this point your friend says, "Wait a minute wasn't she wearing a red sari?" You reply, "No way man, I remember it like it was yesterday, it was blue". All of the other friends agree and now your friend begins to doubt himself. Finally a video of the wedding is pulled out (or a photo album), and surprise, surprise, she's wearing a red sari... multiple people were all 100% sure, and all of them were wrong. This is why even eye-witness testimony is considered unreliable, and with good reason too.

Others

There are many more of these alternative medicines that we could cover, but if we did them all indepth we'd need 10 of these books. We've covered most of the popular ones, and a lot of the remaining ones follow on similar lines. Because medicine is not something to be fooled around with, we urge you to never stop conventional therapy for any ailment that you or someone in your family or friend's circle suffers from. Whilst we realise that it's hard (if not impossible sometimes) to break habits and beliefs, especially when it comes to older people who are set in their ways, it's equally important to put your foot down if they do something stupid. If you really feel happier with wearing a healing crystal around your neck, who are we to judge you? In the end happiness and peace of mind is often hard to find, and if a rock or someone laying their hands on you can accomplish that, more power to you! Just take your medicines as well... that's all. ■

Religion-based

When pseudoscience piggybacks on religion, it is accepted a lot more

It's just normal human tendency to believe authority figures. It starts when we are children and listening to our parents, and then moves on to other authorities. One of the most influential things in our lives is religion, or spirituality. No matter what religion it is, we learn to respect and take certain things for granted because of our beliefs, and often we close our minds off to questioning any aspect of our religion. The doctrine of "faith" is perfect because it demands acceptance. Asking for evidence or questioning is considered to be a weakness, because it shows that you have less faith than someone who doesn't question... it's impossible to win against that argument. Unless, of course, you stop having faith altogether, and refuse to accept that having faith is somehow virtuous. This rarely happens though, and as a result, we tend to have faith in our respective religions. This gives a lot of pseudoscience a platform and a ton of readymade believers, especially when it is based on that religion's assumptions or teachings.

We will cover a few in this chapter, but by no means is it an exhaustive list. Please keep an open mind, and do not make the mistake of ignoring our critique of the pseudoscience as critique of the religion itself, because that is exactly what the proponents of the respective pseudosciences want. They hide the unscientific flaws of their theory by tying it all into a religion, and attempt to get you to believe that refutation of the theory is a refutation of the religion as a whole. Don't let them do that.

Young Earth Creationism / Intelligent Design / Flat Earth theory

Based off the Abrahamic religions (Judaism, Christianity and Islam), creationism is the belief that the Earth is really young, and all of science is just misinterpreting evidence. The belief takes a literal view of the Christian Bible (or the Jewish Torah, or TaNaKh, and the Islamic Qur'an), and proposes that the Earth may be only 10,000 years old, and that dinosaurs and others are just fossils of the animals that were wiped out in the great flood that is mentioned in the Bible. This was obviously easily proven to be false, given that there are an unbroken line of civilisations that have existed for 10,000 years or more, and they failed to mention that they were once wiped out by a global flood!

When creationism failed, because people didn't want to take the word of their holy books as a literal description of the history of

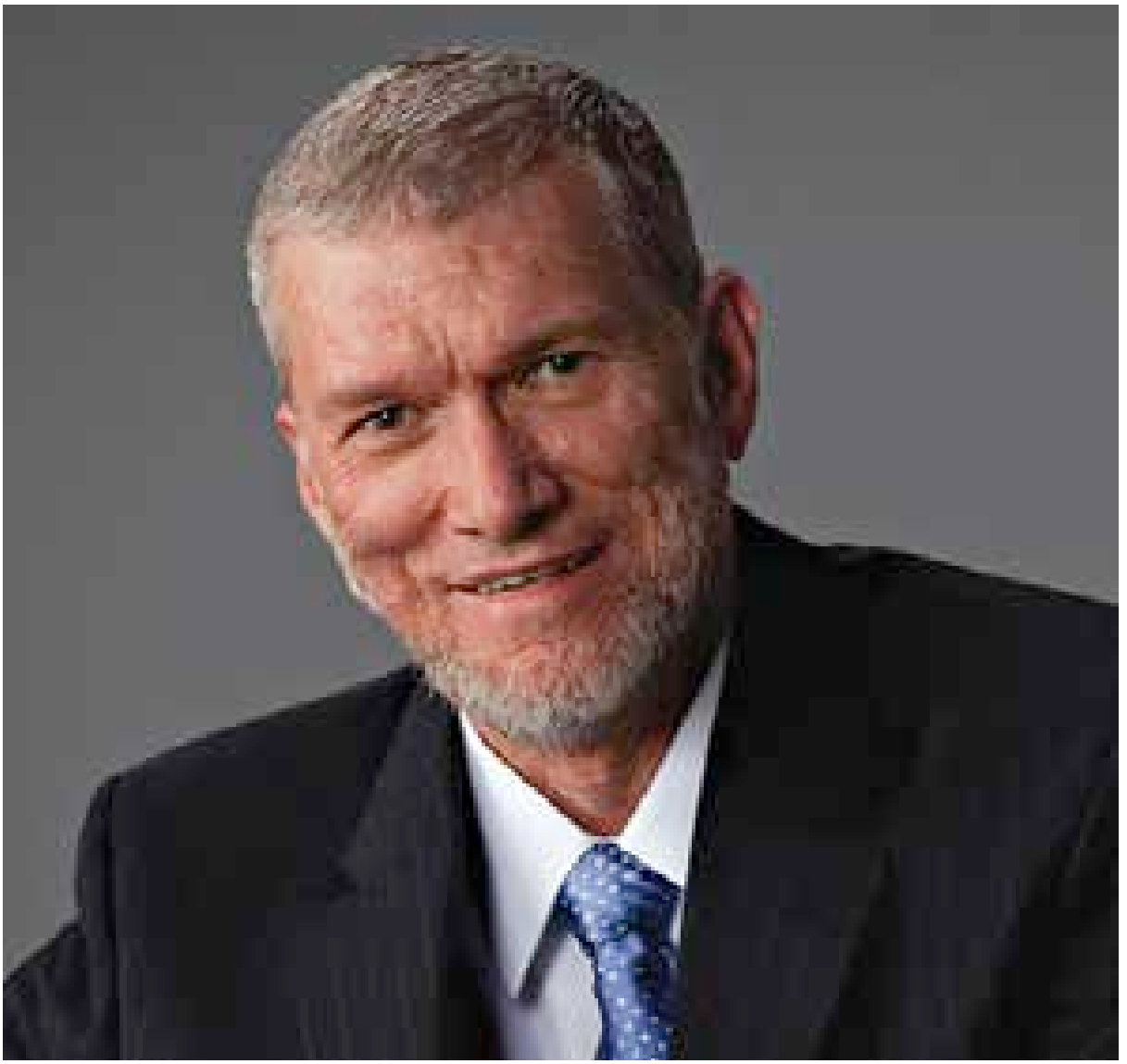


Image Credit: Answers in Genesis

Ken Ham is a creationist who built a creation museum that claims dinosaurs lived alongside humans before the flood

the planet, and instead looked to it for spiritual guidance, Intelligent Design (ID) was born. ID is, well, intelligently designed, to make the same argument as creationism, but very carefully. For one thing, ID

doesn't mention any specific "god", or claim that there is just one god. It merely states that all complexity in nature has been arrived at by a guiding force and a higher intelligence that is considered to be "god". It also does away with the 10,000 year age of the earth, and only aims to attack the theory of evolution by claiming that natural selection cannot explain the complexity of life and living things, but an intelligent designer could.

There are a few arguments that ID makes. The first is that of irreducible complexity, which was first introduced by Michael Behe, a biochemist who believes in creationism. His position is that just like a mouse trap ceases to be a mousetrap if you take away one of its key parts (the spring, for instance) similarly, life is complex and can only be simplified down to a certain level beyond which it cannot be simplified any more. This theory has been proven to be wrong and received a lot of criticism, for obvious reasons.

The second argument is specified complexity, which is something Charles Thaxton, a chemist and creationist came up with. This was then further worked on by William Dembski, a theologian, to become the argument that it is for ID theorists. In his own words, "A single letter of the alphabet is specified without being complex. A long sentence of random letters is complex without being specified. A Shakespearean sonnet is both complex and specified." This is the argument that's then used to look at DNA and arrive at the conclu-

Intelligent design likens this watch to DNA, and claims both have a creator

sion that DNA is indeed "intelligently designed". Dembski also goes on to make wild conjecture about the probability of things (such as the eye) developing on their own by random chance, and then arrives at wild numbers such as one in 10^{150}, etc. Mathematicians and scientists have dismissed his claims as ludicrous, and especially poor in understanding of mathematics, evolutionary theory, and even basic science. It's basically easily disproven: take a coin, and

toss it 1000 times to get a pattern (head, tails, heads, heads, etc). The probability of getting this exact pattern is one in 10^{300}, which is basically impossible, and yet you just got that pattern, right? It's like the impossibility of you winning the lottery. Calculate the probability of you doing so and it seems impossible, and yet someone wins the lottery almost every time. So much for specified complexity!

Next, we come to the "fine-tuned universe theory". The idea stems from physics where there are a few constants that determine the universe. Assume it were possible to change these constants (by twiddling with dials), then even the slightest change in any one of these constants would result in a very different universe, or perhaps, the universe would just cease to exist. This fact is taken by ID theorists and interpreted as there being some fine-tuner of the physical constants, who set things up "just right" for us, and this is why the designer of our universe must be intelligent, in order to ensure we exist. What it ignores is that a designer isn't needed. We exist. We could only exist if things were this way, and if they weren't, well, then we wouldn't exist! You could choose to call the laws of physics fine tuning, or else you could choose to accept them as the facts that they are. Another way to deal with this argument is to ask why didn't oxygen breathers exist when the earth's atmosphere was rich in carbon dioxide? The answer is in the question itself, isn't it? How can you have oxygen breathers existing where there is no oxygen?

Image Source: YouTube

William Dembski

Similarly, we could only live in this universe, with these laws, because it is these laws that allowed us to form in the way we have. Assigning a divine hand to natural laws brings in even more questions than it is trying to answer.

In essence, the ID argument is one of people finding patterns that suit their world view, and then trying to use those patterns to

prove their own confirmation bias. ID has proven to be pseudoscience and quackery, and has even lost court cases when the IDers tried to get the theory taught in school. Scientists have described ID as an argument from ignorance (because it needs ignorance of science facts to argue the theory and even more ignorance of science fact to believe it), and also called it a god of the gaps argument, where people prey on gaps in scientific knowledge to try and insert the divine as an answer, without any factual evidence.

Another common feature of Abrahamic religions is that their books all claim that the earth is flat. Given that it was the belief at the time, this is totally understandable if you do not look at the words in the books and scriptures to literally be the words of the creator god. However, of course, many people do believe that those books are literally the words of a creator god, and so everything that science has discovered about our planet, solar system, galaxy and universe obviously seems wrong to them. After all, it would stand to reason that the whole of the scientific community would know less about the universe than a god who created it... This leads to an interesting dilemma which is solved by claiming (amongst other things) that science is the work of the devil, and that all space exploration is merely a hoax perpetrated by evil governments who are under the control of the devil! We shall now give you a 10 minute break to finish shaking from the uncontrollable laughter you are no doubt

experiencing at this moment. We don't want to dwell too much on this, but we will tell you that there are some flat earther sites and Facebook groups that you can visit or join to have a really good laugh when you're feeling bored...

Reincarnation / ancient tech

We did say we would be fair and evenly ruthless, didn't we? Many Indian and Chinese (amongst others) believe in reincarnation, and even believe in ancient technology. Again, this is because of an understanding and belief of scriptures or religious texts that are considered unquestionable. Beliefs are fine so long as they are personal, but if and when they start being promoted as scientific, they have to stand the test of science like all other theories. Evidence is where religious claims fail, and the reincarnation and ancient technology claims are prime examples of this.

The reincarnation theories are often linked to false memory claims that we have covered earlier in the medical claims section. Apart from making for good Bollywood movie scripts from decades ago, reincarnation really doesn't have to much else going for it. It's not limited to Indian religions, as we have mentioned, but also is a theme found in stories from ancient Greece, and also in the original natives of Australia, Eastern Asia, Africa and even South America. There is no proof about where it originated, and both possibilities (1.

that it originated across the globe independently, or 2. that it spread from one culture to another) could be true. It is considered as one of the three major options of religious belief about what happens to an individual after death – 1. Reincarnation, 2. Heaven or hell theories, or 3. A return to nothingness (the atheistic world view). In India, the idea dates back to the early Vedic period (about 1500 BCE), to the time of the Upanishads.

The Buddhist wheel of life

Reincarnation is considered pseudoscience because it has no way of being tested scientifically. The few times people claim to remember their past lives have been studied (when possible or allowed) and found to be cases of false memories being created in the individual's brain. If memory of a previous life is not possible, then it is also impossible to test scientifically. However, scientific tests have attempted to find the human soul, or aatma, and have failed to prove that there is any different between a person who is living (say on their deathbed) and then the same person when they are dead a short time later. Even claims that the body was lighter after the soul departed it have been proven to be false. With no way to test a belief, it has to be permanently relegated to the world of superstition, pseudoscience and woo, no matter how strongly a person believes in these things.

Ancient technology, however, is also a belief that we Indians love, and unlike things like a soul, these are testable, and evidence of this can be collected or discovered. Although we love to believe that ancient Indians had technology far superior to even what we have achieved today, there is no proof of this. If ancient Indians had nuclear weapons, or flying cars (chariots?), or were capable of advanced surgery... no evidence of any of this has ever been found. One fossil of a human with a rebuilt synthetic arm, or with the body part of an animal, or even the telltale signs of an ancient

nuclear weapon, or the remains of a flying chariot would forever silence modern science and cause us to accept the ideas of ancient technology, however, none have been found. It is a similar story to the pyramids in Egypt, where tall claims are made – but they at least have the pyramids to support those tall claims! Until evidence is found that says otherwise, science will always consider claims of ancient technology to be pseudoscience.

Astrology

Like most other ancient beliefs, astrology too was something that sprung up across the globe. We might never know if it was an idea that spread from one set of people to another or was something that came about independently, but it is widely believed to have all sprung up independently. The night sky, when viewed without the light pollution of modern cities (as was the case thousands of years ago), is a breath taking sight, and it is a sight visible to anyone looking up, no matter where on earth they are. It is obvious that all human civilisations would eventually find directions with the help of stars and also notice patterns in them that would help predict seasons. It would also stand to reason that the sight of millions of stars would be associated with something supernatural, and would eventually find their way into religious beliefs in some form or another.

Egyptian zodiac

It is the idea that the stars somehow govern our lives that essentially makes up what we know as astrology today. Because the earth revolves around the sun, there is a change in the constellations that dominate the night sky at different times of the year. This would have been noticed, and the idea that the constellation that "dominated the sky" at the time of your birth would eventually be incorporated into religious belief. Whether it is the Western idea of the zodiac, or the ancient Indian, it has all proven to be totally pointless. All prediction that all religions make about people or events based on the reading of the stars have been proven false. This is why science considers astrology quackery, or pseudoscience. Although most of us cannot help but look at our horoscopes in the papers (or online), these things have been proven to be fraudulent practices with no bearing whatsoever on real life. Of course you might still go to a jyotish to have your kundali looked at based on family pressure, just don't take it all too seriously and let it control your life... ■

Conspiracy theories

Put on your tin foil hats!

Life wouldn't be interesting without a conspiracy theory or two. If anything, our propensity to believe in conspiracy theories seems to have increased as we have had more access to the internet, which is surprising, because given that humanity now had access to all the information of the world, it's surprising that it chose to believe in conspiracies!

Again, we will look at merely a few in this book, and by no means do we suggest that this is an exhaustive look at such theories, because there are literally thousands of conspiracy theories doing the rounds online, and new ones keep coming up every day!

Anti-government

It's a popular theme that people follow online. Distrust of governments is the most popular conspiracy theory, and this brings with it distrust of all government announcements. The problem, however, is that often governments can lie in order to further an agenda,

which makes it seem probable that all conspiracy theories are true. This isn't the case, but the governments of the world lying to their citizens and then being caught out doesn't help promote the cause of rational beliefs.

The conspiracy theory that Iraq had weapons of mass destruction (or even that they had a WMD programme) were eventually found to be totally false. In fact, there are now conspiracy theories about whether the US government was acting on bad intel, or whether they made up the whole thing just to get rid of a government in the middle east to further their own global agenda. It is revelations such as these that give plausibility to the other conspiracy theories, sadly.

George 'dubya' Bush found no WMDs in Iraq

Medical

The most common use of conspiracy theory propaganda is by those pushing "alternative medicine"

(some of which we have covered earlier). Because often it is government bodies that shut them down (as they should), it becomes easier to push their private agenda by wrapping it up in distrust of the government as a whole. Most pushers of alternative medicine will cry foul, make wild allegations and even make up conspiracy theories about governments being in bed with "big pharma", etc. This in turn then leads to governments being more lenient towards alternative medicines, which means the average citizen loses out, as he or she might be spending hard-earned money on cures that don't actually work – all because politicians don't want to risk pissing off the electorate, and tiptoe around groups (such as conspiracy theorists) that make a lot of noise.

Popular medical conspiracy theories are:

AIDS: A popular theory is that AIDS was a man-made disease – created in a lab.

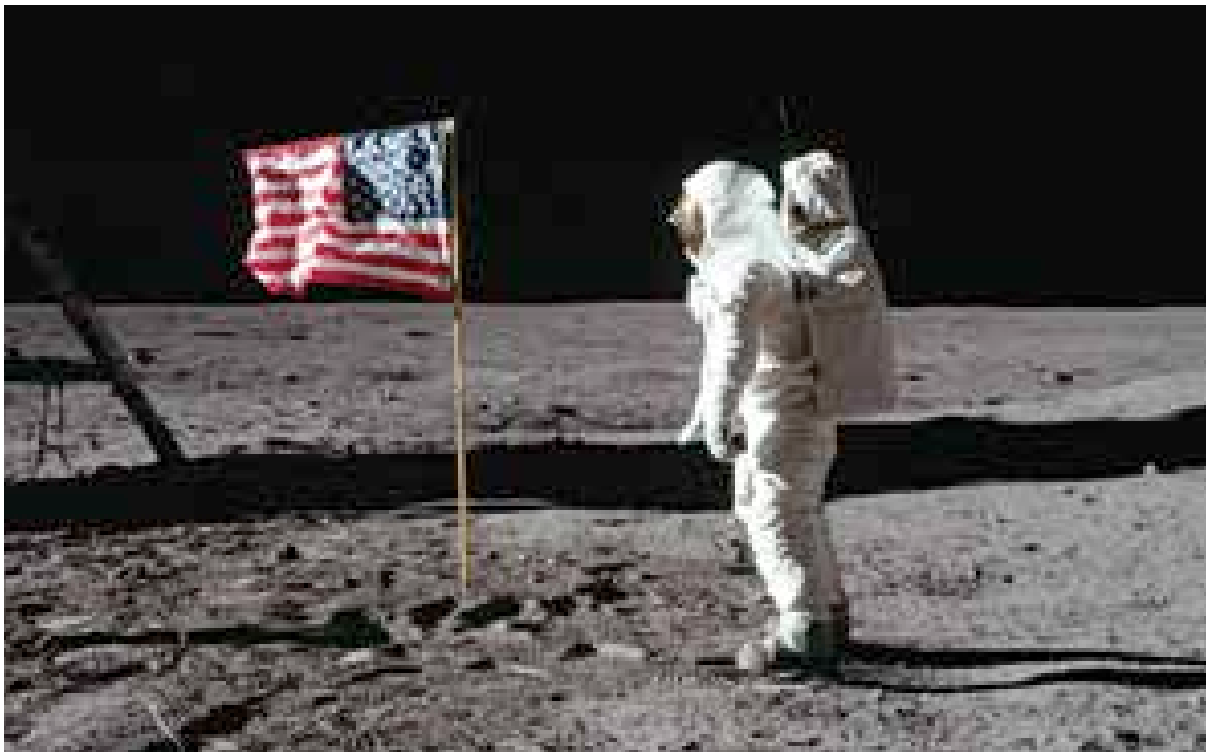
Made up diseases: Conspiracy Theorists (CTs) believe that there are many conditions such as ADHD and even diseases such as the Herpes simplex virus that are made up by big pharma in order to sell more medicines!

Vaccine genocide: Muslim clerics in Nigeria have spread rumours that the WHO are infecting Nigerians with HIV under the guise of administering polio vaccines. This has led to the decrease of children vaccinated in Nigeria, which, unsurprisingly didn't reduce

the amount of people catching HIV, but drastically increased the amount of polio cases!

Space

The most popular conspiracy theory is that the Apollo missions to the moon were fake and staged in Hollywood studios. There are entire websites dedicated to this theory, and there are plenty of people who point out oddities in the photographs taken by the astronauts on the moon. Because the astronauts trained on sets which had terrain designed to mimic the conditions on the moon,



Moon landing conspiracy theories are a dime a dozen

and photographs of these were released to the public by NASA, the imagination of some people ran wild and the conspiracy theory of faked moon landings was born. There are even offshoots of the main idea, and some believe that the first moon landing was faked because the Russians were close to setting off for the moon, but subsequent missions actually did go to the moon. Needless to say, no matter how many clarifications and explanations scientists offer for the theories, this is a conspiracy theory that isn't going away anytime soon.

The UFO and alien conspiracy theories suggest that earth has been visited by aliens, and that governments around the world have covered them up. Whilst mostly centered in the US, there are also conspiracy theorists across the globe who also suspect their own governments. From theories as wild as all modern technology being actually learnt from crashed alien craft to the world being ruled by shape-shifting alien reptiles who drink human blood to be able to appear in human form... there are all sorts of conspiracy theories out there. Needless to say, none are taken very seriously. Area 51, the face on Mars, Jupiter's red eye, and pretty much everything NASA or other space observers have ever reported on eventually end up being converted into some conspiracy theory or another, perhaps because space does instill us with wonder, and this allows overactive imaginations to run amuck!

Earth

There are also plenty of conspiracy theories about the earth and especially about the earth's history. One such theory is that of the Bermuda Triangle, which is a triangle drawn out on maps to the south east of the continental US, just off the shores of Florida. There have been reports in the past of ships and planes disappearing under mysterious circumstances, and this has fueled the theory that there is something amiss in that region. However, those who push this theory of a deadly triangle in the Atlantic ocean, often fail to mention that there is no evidence that this area has any more ships or planes disappearing than any other patch of equally busy ocean. In fact, given that the area is prone to a lot of cyclonic activity, and is still such a busy and well used corridor, it's surprising that there aren't more such

Jules Verne – you must read The Journey to the Center of the Earth

disappearances in the area. Often theories of the ancient island or continent of Atlantis are conflated with the Bermuda Triangle to come up with a paranormal explanation. There are even those who believe the Atlanteans are living under the Atlantic ocean, and abduct or shoot down planes and ships that have spotted them when they arise to the surface.

Another conspiracy theory is the Hollow Earth theory, which claims that the planet is hollow, or at least that it contains a lot of subterranean space where entire ecologies of plant and animal life reside. From assuming this "underworld" to be everything from hell to a place where strange demons reside, and even a place where the Druids came from (and went back to). In popular writing, the most famous story that deals with this is obviously Jules Verne's *Journey to the Center of the Earth*. Needless to say, this is a conspiracy theory that modern science does not take seriously, at all.

More government lies

Of course there are hundreds of theories about governments or powerful people or groups conducting operations across the globe. The 9/11 conspiracy theorists believe 9/11 to be an inside job of the US government. Some believe that the government knew about it but let it happen so they could have a war. This is not new, as there are people who believe the same about the Pearl Harbour attack.

The 9/11 Attack is considered by many to be an inside job

Then come all the assassinations of important people. John F Kennedy is the most famous assassination that is claimed to be an inside job. The conspiracy also extends to the death of his supposed lover Marilyn Monroe. Conspiracy theories about Princess Diana being assassinated as opposed to being killed in an accident are also widespread, and the same goes for almost all of the celebrity deaths that have ever happened. Elvis Presley's death was considered to be a hoax, and many believed he was living as a recluse. The same is often said of Michael Jackson's death. There are also theories about

celebrities being killed for money, or jealousy, or other reasons, especially when the deaths are officially listed as suicide or overdose of drugs. From Whitney Houston to Kurt Cobain, John Lennon to Bruce Lee and Jimi Hendrix to Tupac, there are conspiracy theories coming out of our ears online!

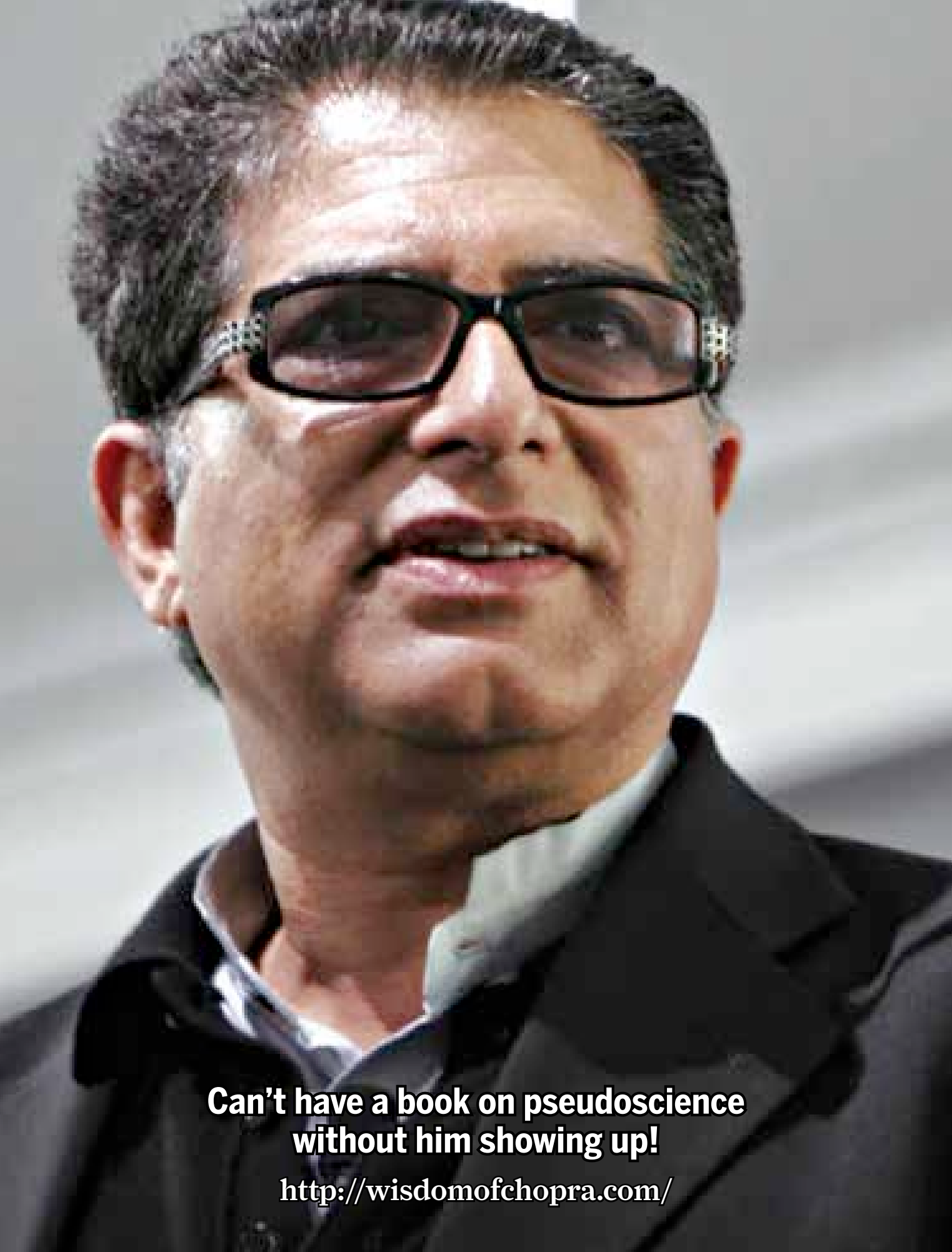
The truth of Diana's death was tragedy enough without needing a conspiracy theory

Conclusion

Humans are distrusting by nature. We don't like the official line, we don't like things to be simple and obvious, and we're bound to look beyond the obvious. We pattern match and see things where there is nothing to be seen, and this, some believe is nothing more than a remnant of what was once an evolutionary trait. When we were still primitive cavemen, wandering across the Savannah, and heard a rustle in the bushes, we had a choice to make. Was that the wind, or was that a predator? The penalty for being wrong is you thought it was the

wind was death, and the penalty for being wrong if you thought it was a lion and ran, was nothing more than a scare. Natural selection would have worked and selected for the individuals who always ran, predator or not. Some scientists think this could be a reason why we are likely to believe in more abstract things, and are willing to believe in things without evidence, even if they appear ridiculous. Conspiracy theories and pseudoscience might be a case of us seeing lions in bushes where there are none. The only problem is that the people who peddle the pseudoscience are often the predators... Think of it as a smart lion waiting downwind for you to hear a rustle ahead and run straight towards him... The biggest reason why we need to work past our tendency to believe things without evidence, and use the scientific method to arrive at the right answers is that we cannot trust our gut instinct.

As always, remember to drop us a line at *dmystify@digit.in* and tell us what you thought of this book. We're expecting a lot of hate mail this time, given that we've undoubtedly pissed off a fair share of people, as we've tried to tackle unscientific belief systems of everyone we can think of. ■


Can’t have a book on pseudoscience
without him showing up!
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