

Evolution of science

About 400 B.C. to 300 B.C.

Many civilization did not get much further than saying “**god did it**” and “do not ask how we will burn you alive”

PLATO – who was a first thinker of science and set up “ACADEMY” IN ABOUT **387 BC**.

ARISTOTLE - After 20 years a new pupil young Aristotle joined. He born in north Greece in **384 BC**. His father was doctor and died when he was young. His guardian admitted him Plato’s academy. He continued there for 2 years as pupil & teacher. Aristotle however that “people should observe world carefully before try” by to explain, it is about the most fundamental rule of science.

He was one of the first scientific type thinkers. He invented

- 1) **Physics**
- 2) **Biology**

Also some this about

- 1) **Sports**
- 2) **Cosmetic**

He thought that universe was made with (5) things matters substances

- 1) **Earth**
- 2) **Air**
- 3) **Fire**
- 4) **Water**
- 5) **Ether**

Aristotle no concept of gravity he thought that

Nature of water less heavy – lie on surface of earth

Nature by air to be light than water, it took its place above the sea & land

Nature of fire to be light than air so flames flow up words

Natural qualities

Earth is dry & cold

Water is wet & cold

Air is wet & cold

Fire is dry& heat

Aristotle also thought that

There was a god like being behind it all, who had designed things to be

- 1) Rational
- 2) Logical
- 3) Orderly
- 4) Harmonious

Aristotle 's secret science scroll

MENTAL MELT WHEN HEATED BECAUSE THEY'RE MADE OF EARTH AND WATER, AND HEATING THEM MAKES THE WATER SHOW ITSELF.

YOU DON'T NEED TO HELP AN APPLE FALL BECAUSE IT WANTS TO REACH THE EARTH, BUT YOU HAVE TO PUSH A CART ALONG BECAUSE IT'S HAPPY WHERE IT IS.

WATER PUTS OUT FLAMES BECAUSE OF THEIR OPPOSITE NATURES.

Aristotle was stunningly brainy, had plenty of family cash, at the age of 37, he probably expected to become Mr Academy Numero Uno. But actually Plato's nephew got the job, and Aristotle went off in a huff and a boat. He went to the court of Hermias, ruler of Atarnos. Hermias was an ex-pupil of the Academy and Aristotle got on well with him. After a while, Academy and Aristotle got on well with him. After a while, Aristotle married Hermias' niece, Pythias. It's said that Aristotle spent their honeymoon collecting interesting sea creatures.

Aristotle didn't just investigate animals individually. He wanted to relate them to each other and classify them too. Before Aristotle's time, animals were mainly classified by the number of legs they had:

- 1) **Fish were watery creatures, found in the sea and rivers;**
- 2) **Plants were earthy things, found in the ground;**
- 3) **Animals and birds were airy, founded in the air and shy.**

After a few years spent happily poking about in rock pools and rather less happily chopping up the animals he found in them, Aristotle heard that his childhood pal Philip, now king of Macedonia, had a son whom he wanted Aristotle to teach. So Aristotle went back to Macedonia and became tutor to **Alexander, aged 13**. Alexander-later to be known as the 'Great'- went on to conquer half the world known to the Greeks.

In 335 BC, after three years of teaching, Alexander went off to do a bit more conquering, and Aristotle went back to Athens. But he was still rather cross about not being made boss of the Academy, so he decided to go to another university type place. Unfortunately there weren't any, so he created his own and called it the Lyceum, it was a bit different from the Academy in that the people who worked there were more into maths and looking at things. And unlike the Academy it had a library and a museum.

Aristotle, and the Lyceum, became very popular for a while. In fact, most of Aristotle's surviving writings are notes for lectures at the Lyceum, which is why they tend to be a bit scribbly and scruffy.

Aristotle stayed happily at the Lyceum until 323 BC, when Alexander died.

It was thought that Aristotle, having spent so long in Macedonia and having so many Macedonian friends, was a lot keener on Macedonian friends, was a lot keener on Macedonia than he should be, **and he was accused of being disrespectful to the gods. Something similar had happened not long before to a philosopher called Socrates, who ended up sentenced to death**, so Aristotle decided not to hang around and wait for this to happen to him. He fled to Colchis where, a few months later, **he died, aged 62**. We don't really know how, but it's said he threw himself into the sea because he couldn't work out how the tides worked. Which just goes to show, you can be too keen on science?

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FROM 300 B.C. TO 1642 A.D.

After Aristotle's death, many other Greek thinkers followed his teachings, but most of them didn't do much more than copy his works. The contents of the lyceum library were eventually transferred to a super new library at Alexandria, full of colour photocopyers, broadband internet connections and glossy magazines (or their ancient equivalents). Then, in **146 BC**, Greece was absorbed by the Roman Empire. The Romans were good at things like conquest and admin, but had no time for scientific thinking, so there was hardly any progress in science while they were in charge.

After the Roman Empire broke up in **AD 285**, everything got a bit grim and quiet in Europe and there was very little scientific progress for over **1,000 years**. The lyceum and Plato's Academy were closed and the great library at Alexander was destroyed. However, some of Aristotle's writings survived in Arabia and in about the **fifteenth century** they, along with other Greek writing, were translated into Latin and became available in Europe. Everybody was most impressed and started to adopt ancient Greek ideas about art and philosophy. **The period was called the renaissance, which means the rebirth.**

Partly because it fitted with the biblical idea that the earth was the centre of the earth was the centre of the solar system, Greek science enthusiastically adopted by the Catholic Church, which dominated Italy and many other parts of Europe. Aristotle's theories in particular, in a modified form, became official doctrine for centuries.

Anyone who wanted to take on Aristotle would have to be clever, brave, outspoken, witty and reckless, with powerful friends to protect them.

Galileo was born in Pisa, Italy, in **1564**. His dad, Vincenzo, was a musician and a bit of an amateur scientist who liked to criticize Aristotle's teaching from time to time. This led to lots of arguments.

Galileo's dad decided his son should be a doctor, so Galileo was sent to Pisa University to become one. As it turned out, Galileo didn't like doctoring much and he used to sneak into the far more exciting maths lecture from time to time. He liked them so much that, encouraged by the maths lecture, **he dropped medicine and took up maths instead. He had a bit of a row with his dad about this. He had a bit of a row with the most people.**

Galileo thought all explanations of Aristotle need to be tested by observation and experiment. And that's what he did. One day when he was supposed to be listening to mass in the cathedral; **he noticed a lamp that had just been lit. It was swinging from side to side and gradually slowing down. Galileo didn't have a watch with him because they hadn't been invented yet, so he limited the swing with the pulse, and found that the swings seemed to last the same time whether they were wide or narrow.**

Galileo discovered that the time a swing took did not depend on the weight of the pendulum, which is really rather odd (and was not fully explained until Albert Einstein arrived on the scene). He also discovered what a brilliant tool maths was for describing things exactly.

In 1585, Galileo left Pisa University – with no degree.

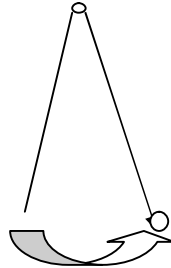
Galileo also made friends with the marquis Guidobaldo del Monte, who got him a job as professor of maths - in Pisa.

Galileo behaved at the university just as he had as a student – he argued about everything.

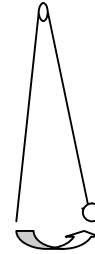
He had good friends too and was enjoying himself applying his clever 'observe/measure/experiment/reason/calculate' approach to motion.

THE PENDULUM LAWS

1. A PENDULUM TAKES THE SAME TIME TO SWING FROM SIDE TO SIDE WHETHER ITS SWINGS ARE NARROW OR WIDE

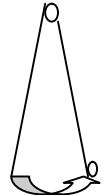


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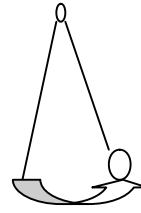


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2. A PENDULUM TAKES THE SAME TIME SWING FROM TO SIDE HOWEVER HEAVY IT IS.

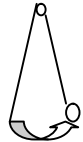


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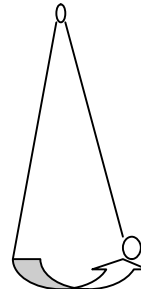


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3. A PENDULUM FOUR TIMES AS LONG AS ANOTHER WILL TAKE TWICE AS LONG TO SWING FROM SIDE TO SIDE



1 SECOND



2 SECONDS

LENTH	1 4 9 16 25
TIME	1 2 3 4 5

Aristotle reckoned that heavy objects fall faster than light ones. Like most of Aristotle's ideas fall faster than light ones-feathers fall slower than stones- but Galileo noticed that heavy and light hailstones fell together and was sure that, on the whole, object fell at the same speed however heavy they were. He couldn't imagine that a falling object would slow down if it split up, as Aristotle predicted.

In fact on earth, the resistance of the air means that objects fall at different speeds- dense objects fall faster. So a big heavy thing like a king size duvet will fall more slowly than a small light thing like a marble. However in a vacuum, where there is no air to create resistance, all objects fall at the same speed.)

His contract at Pisa University came to an end. Since he'd irritated so many people, it wasn't renewed. He was out of a job..

When Galileo was 35, he settled down with a woman called Maria Gamba, and they had their kids together the fact that they weren't married didn't make much difference to them, but it did to their two daughters. Because they'd been born to an un married couple, they were – rather weirdly- considered un marriageable themselves.

In 1543, before Galileo was born, a polish scientist called Nicholas Copernicus had published a book suggesting the earth went ROUND the sun, *Aristotle, and most other people, had always assumed the sun went round the earth, and the bible implied that too.* But Galileo thought Copernicus was right and, in 1597, he wrote to a German scientist called Johannes Kepler about it.

The Aristotelians claims that the star must be within the orbit of the moon have been contradicted by Galileo, whose calculations show that it cannot be : if it were, it would be seen in different parts of the sky depending on where it was observed from.

The Aristotelians are not impressed spokesmen said today, ' why is he bothering to make observations of something that is clearly explained in Aristotle books any way'?

In 1609 he pointed his home made telescope at the night sky, and discovered:

1. MOUNTAINS ON THE MOON
2. MILLIONS OF STARS NO ONE HAD SEEN BEFORE
3. FOUR MOONS OF JUPITER

All this discoveries made Galileo certain that Aristotle was wrong about his theory that everything in the universe goes around the earth he could see that the moon of Jupiter didn't, for a start, and changing size and shape of Venus only made sense if it was travelling around the sun.

In 1615, Galileo decide to take the question to the top, to the pope in a Rome. Which was a bad move. The pope -Paul v-was not interested in science and set up a committee to decide whether Galileo's views contradicted the Bible (Never mind whether they were right). The committee decided they did and Galileo got a proper telling –off. He was also told that, unless he renounced his theory, he would be forbidden to discuss the idea of a moving Earth again.

After about 20 years the book written by Galileo was banned and Galileo was summoned to Rome, to be tried before the scary inquisition. In 1633 he made the long journey. He was 69 – by that age, most people in those days were dead. Galileo soon wished he was too...

He was forced to make a statement saying that the earth absolutely definitely didn't move a centimetre in any direction whatsoever, forbidden to write anything further and sentenced to imprisonment –for life.

He spent the rest of his life there, under house arrest, and headed letters that he wrote 'from my prison'. But he was allowed to visit his daughter, and he even managed to entertain a new visitor and talk science with them. Very quietly.

Galileo's favourite daughter died in 1633 and, by the time two new sciences was published, he was blind but still he kept working. One of the last things he did was to invent the basis of a pendulum clock, which he got his son to draw for him. **He steered well clear of the solar systems, but two world systems, though banned for almost two centuries by the church, did its work and gradually the sun-centred theory became accepted by most scientists. He died in the year 1642**

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AD 1642 to A.D.1726

Isaac Newton who was born in 1642 is one of the greatest scientists who ever lived, Isaac's dad had died before he was born.

Modern science is well organised way of doing something which people have been trying to do from thousands of years.

In 1663, at the age of 21, Isaac suddenly began to question the scientific theories about the universe that were knocking about just then he bought a prism and used it to make rainbow patterns on his walls.

Like other top scientists, Isaac preferred to work on his own, and wasn't too keen on the regular lectures, so it was by no means sure he would pass. He did though, just.

In 1665, Cambridge, like London and all other cities, was full of rats. The rats were full of fleas and the fleas were full of plague. Soon people were dying horribly all over the place- at a rate of to 7,000 a day. The university was closed and Isaac went home to woolsthorpe where he stayed for 18 months. What he did there revolutionized science...

One day- so it's said – Isaac was sitting in the orchard when....which made him think about gravity.

After a while, the plague faded away, Isaac went back to Cambridge University, where he managed to get a fellowship. All he had to do was give 20 lectures per year.

At the age of 26, Isaac became a proper professional professor in 1669.

Why was Isaac so keen on all this? For one thing, it seems that he thought that in the good old days there had been geniuses who knew everything.

The identities of the geniuses had been lost but their amazing knowledge was legendary.

Isaac was determined to unearth these lost secrets again.

Another thing is that Isaac really, really, believed in god. But he also really, really believed in science.

The royal society loved Isaac telephone and, when he made them one, they invested him to join. He was very pleased and sent them a paper containing. His discoveries about light and colour.

LAWS OF MOTION

First law (discovered by Galileo)

Moving objects keep moving unless messed about with

Stationary objects keep still

Second law

If you hit an object, its news speed and direction depends on how hard and in what direction you hit it.

Third law

If one objects another, it is equally affected by it.

Laws of gravity

Every object in the universe attract every other objects, and the gravity pull between two objects (e.g. apple and the earth) is stronger if the objects are more massive, and weaker if they are farther apart.

He gives a working mathematical model of the whole solar system that not only explains it all but allows it feature should be predicted. As if that wasn't enough, he explained how to weight planets...

Planets with moons hold them in place with gravity. The heavier the planet, the stronger his gravity, so the faster it's moon(s) orbit to avoid spiralling in. So by measuring the speed of a moon, the mass of the planet can be calculated.

He even succeeded where Aristotle and Galileo had failed and explain the tides...

Tides are caused mainly by the moon's gravity and partly by the sun's gravity. When the sun, earth and the moon are lined up, tides are highest.

Isaac seems to have had very few love affairs in his life but there is some evidence that he had one or two.

He died aged 84 (around 1726), uncomplaining about the pain of his illness and showing no fear of death.

NEWTON – THEORY OF GRAVITY

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Michael Faraday: He born in London slum in 1791. In spite of poor schooling he made massive breakthrough in chemistry and physics, invented new forms of technology

Michael's magnetic mission

Electricity was still a fairly new and exotic discovery- the first battery had only been invented in 1799, all most people knew about it was that it could them a nasty shock.

Encourage by his success; Michael continued with his project to prove that all natural forces were linked, starting with electricity.

A real mark of Michael's genius was something which Newton and Einstein shared (but Aristotle didn't); when he couldn't explain something property, he was some half – baked theory which he was unable to prove.

"I WONDER IF HEAVY OBJECTS FALL IN GRAVIATIONAL FIELDS PRODUCE ELECTRO – MAGNETIC FIELDS THAT I CAN DETECT? "

TOP DISCOVERIES:

- ⊕ New materials
- ⊕ Laws of electricity
- ⊕ Electric motor and electric generator
- ⊕ Force fields

NON – SCIENTIFIC INTEREST:

Religion

Michael left a lot of friends too, and one of them was Charles Darwin. He died in the year 1867 having begun one of Science's greatest theoretical breakthroughs, which became known as field theory.

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CHARLES DARWIN 1809 to 1882

He was born in Shrewsbury in 1809. His mother died when he was eight, so he was brought up by his sisters

School Report	
<i>English:</i>	<i>Average</i>
<i>Latin:</i>	<i>Average</i>
<i>Mathematics:</i>	<i>Average</i>
<i>Geography:</i>	<i>Average</i>
<i>History:</i>	<i>Average</i>
<i>French:</i>	<i>average</i>
General comments: Charles is a timid boy and he's not the most exciting of pupils. The most interesting things he does is collect beetles. Also shells.	

When he was 16, Charles's dad encouraged him to try curing local people who couldn't afford a proper doctor and then sent him to Edinburgh university to learn to be a medicine.

Like Galileo, Charles wasn't impressed with medicine. He found the lectures dull, the subject boring.

Charles had fun at Cambridge, hunting and shooting animals and making friends. He made two sorts of friends: 'dissipated low-minded young men, with whom he got drunk, sung and shot things; and senior scientists, with whom he discussed science.

On 27 December 1831 the voyage began, with Charles as scientific adviser. It was a bit like star trek- along mission to exiting unknown places.

In 1835 the beagle landed at the Galapagos Islands, which were covered in blank sand, smelled like they'd been in the oven too long and were populated by giant tortoises which Charles liked to ride about on and then eat.

After five years Charles was home again, in a ship bulging with samples and with a mind bursting with ideas, quite convinced of that.

Go it! This is how it works:

1. Every pair of animals produces many children and many many grandchildren enough to cover the whole earth in a few generations if they all survived.
2. There is nowhere near enough food to support more than a tiny fraction of the animals that are born.
3. The animals will compete with each other food and the losers will starve.
4. The winning animals will be the ones that are best at exploiting the place they live in – perhaps because they are the cleverest hunters or the strongest fighter or because they can escape their enemies by hiding or running or outwitting them.

Charles called this process, by which strong creatures survived and weak ones died, 'natural selection'. It was how evolution working.

DARWIN - THEORY OF EVALUATION

There is how ever a big gap in the theory of evolution, as Charles knew , in the origin of species he said " No one can say why the some peculiarity in different individualsis sometimes inherited and sometimes not so ; why the child often reverts in certain characters to its grandfather ..."

The word scientist was invented in 1833. Science, laboratories etc. Start as in 19th century.

He died in 1882 after a heart attack.

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