Islam, Rationality and Science

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Religion vs science?

> *"Faith is the great cop-out, the great excuse to evade the need to think and evaluate evidence. Faith is the belief in spite of, even perhaps because of, the lack of evidence."*
>
> — Richard Dawkins

In the past two centuries a new idea has emerged and prevailed: that science and religious faith cannot sincerely co-exist. In other words, religion is inherently irrational. And so any sincere person must either have a sincere religious faith or embrace science and reason and then become atheist or at best, agnostic. In Europe, this idea is now in full swing, helped by a moral philosophy, secular humanism, that argues that humans can manage ethics and altruism without the help of religion.

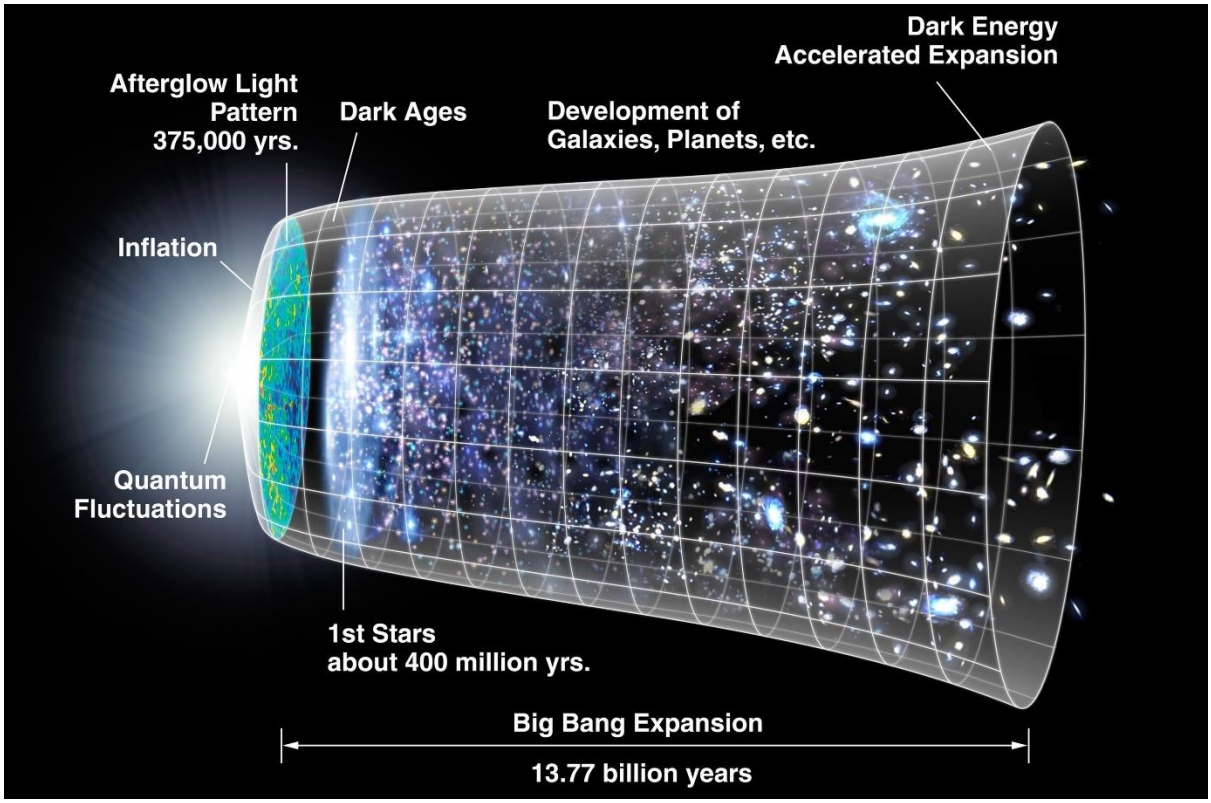
In 1943, the then Archbishop of Canterbury, William Temple, warned: "Christian tradition... was in danger of being undermined by a 'Secular Humanism' which hoped to retain Christian values without Christian faith." His fears have been realised. In 2022, the UK census revealed that for the first time, Britain was no longer a majority Christian country (Christians dropped from 59% in 2011 to 46% in 2021).[1]

What is probably not well known, is that for the longest time, scientists felt no inherent contradiction between scientific pursuits and their faith, indeed they felt that investigation into the nature of the world reinforced their belief and wonder at the artistry of the Author of the Universe, the Supreme, Ultimate Creator, the Lord of the Worlds. This is exactly what the Qur'an suggests about people of knowledge and investigation ('those of understanding'):

> *"Indeed, in the creation of the heavens and the earth and the alternation of the night and the day are signs for those of understanding. Who remember God while standing or sitting or [lying] on their sides and give thought to the creation of the heavens and the earth, [saying], 'Our Lord, You did not create this aimlessly; exalted are You [above such a thing]; then protect us from the punishment of the Fire.'"*
>
> (Qur'an 3:190-191)

[1] https://www.theguardian.com/commentisfree/2022/dec/04/cant-blame-immigration-if-britain-no-longer-can-see-itself-christian-country#:~:text=Only%2046.2%25%20of%20the%20population,a%20third%20of%20the%20population.

These beautiful verses indicate that there is a pattern and order to creation and that scholars are those who investigate ‘God's signs’, discovering the melody of purpose behind them, seeking understanding and becoming struck with awe.



Timeline of the expansion of the universe

https://en.wikipedia.org/wiki/Big_Bang#/media/File:CMB_Timeline300_no_WMAP.jpg

Despite the best efforts of the atheism movement, even today much of the world’s scientists find no dissonance in pursuing the search for understanding and holding a religious belief. Even in the US, a 2009 Pew Survey found that 51% of American scientists believe in God/a Higher Power.[2]

Whilst these figures may be lower now, and lower still in Europe, they would be much higher in the Muslim world.

[2] https://www.pewresearch.org/religion/2009/11/05/scientists-and-belief/#:~:text=According%20to%20the%20poll%2C%20just,universal%20spirit%20or%20higher%20power.

The atheism revolution

Where this is leading, is that the notion that science and faith cannot coexist is more than anything a viewpoint, a contention, a new belief. This novel perspective reflects the success of the atheism movement, which, although rooted in the Enlightenment era's advocacy for free thought and buttressed by the French Revolution, began to significantly influence Western thought towards the late 19th century through the works of notable individuals such as Shelley, Marx, Darwin, and Nietzsche. There is no doubt that these thinkers and many who followed them, emerged out of a context replete with narratives of official religion's opposition to scientific enquiry and this led them to the conclusion that the two cannot genuinely coexist.

Just as it would be unfair to assume that the same narrative existed in other cultures, it would also be out of place in this article to speak for other religions, so let's specifically explore what Islam has to say about reason, and by implication, the child of reason: science. The atheist proposition that the absence of God's proof proves the absence of God, we will also set aside for this particular piece.

Instead, here we'll challenge the primary contention that Islam is against science and reason. We will start with exploring the foundation stone of Islam, the Qur'an, moving onto the approach towards science, of the Prophet Muhammad (peace be upon him) and finally to how, based on these sources, learned Muslims over the centuries approached the reasoned investigation into the natural world...

The Qur'an and evidence

Opposition to the blind following of the past:

> *"When it is said to them: "Come to what God has revealed; come to the Messenger," they say: "Enough for us are the ways we found our fathers following." What! even though their fathers were void of (sound) knowledge and guidance?"*
>
> (5:104)

Essentially, the Qur'an was proposing a movement of free-thinking, where past beliefs or traditions were not to be seen in anyway as valid proofs. When Prophet Muhammad (PBUH) spoke out for a rational monotheism in a pagan society, his ideas were seen as strange, dangerous and contrary to established tradition. His movement was inconvenient, to put it mildly, yet he felt obliged by truth, to press forward, despite the opprobrium and eventual oppression that resulted.

The philosopher Bertrand Russell nicely articulates this notion:

> *"What makes a freethinker is not his beliefs but the way in which he holds them. If he holds them because his elders told him they were true when he was young, or if he holds them because if he did not he would be unhappy, his thought is not free; but if he holds them because, after careful thought he finds a balance of evidence in their favour, then his thought is free, however odd his conclusions may seem."*
>
> (The Value of Free Thought, 1944)

The Qur'an tells the story of Abraham's journey of free thought, where, on the search for God, he turns his back on his people's tradition of worshipping of idols and considers natural phenomena, before finally reasoning that God must be singular, supreme, almighty and beyond the visible world (Qur'an 6:75-83).

Following assumptions and suspicions without proof:

> *"O you who believe! if an impious person comes to you with any news, ascertain the truth lest you harm people unwittingly and afterwards become full of repentance for what ye have done."*
>
> (Qur'an 49:6)

The imperative to establish evidence was not taken lightly, but rather extended by Muslim scholars to all areas of learning and endeavour. In hadith studies, when searching for genuine traditions about the Prophet (PBUH), scholars quickly evolved system that outright rejected hearsay. Instead they devised a precise and scientific methodology, involving chains of narration that was meticulously matched to detailed biographies of each narrator. These biographies extended into volumes and the skill and learning required to validate hadith and by extension, reject the majority, was left to specific experts who dedicated themselves to the 'science of hadith' (ulum al hadith).

In jurisprudence and law, scholars of the four leading schools agreed around the legal maxim: *"certainty shall not be removed by doubt."* This overarching rule insists that nothing should change until there is certainty of evidence for it to do so. This for instance confirms that the accused remains innocent until his guilt is firmly proved.

Following whims:

> "They follow nothing but conjecture and what their own souls desire, even though there has already come to them Guidance from their Lord."
>
> (Qur'an 53:23)

Though we claim to live in a scientific age, supernatural and indeed, superstitious beliefs abound. Somehow people are content with the likely dissonance that such beliefs may demand. It is fashionable these days to 'choose' a supernatural belief based on one's feelings. "I feel that mother earth is a spirit that nurtures us all."

The Qur'an on the other hand, demands that whims and feelings should not be allowed to form conjecture and thence belief, rather one's faith should be based on enquiry and what you conclude to be true, in all probability.

Following priests without evidence:

> *"They take their priests and their anchorites to be their lords in derogation of God and (they take as their Lord) Christ the son of Mary; Yet they were commanded to worship but one God: there is no god but He. Praise and glory to him: (far is He) from having the partners they associate (with him)"*
>
> (Qur'an 53:23)

Again, the Qur'an requires Muslims to personally investigate the evidence and follow that, rather than what certain authorities claim is the truth.

The Qur'an and scientific phenomena

The Qur'an did not attribute any mythology to natural phenomena, rather it insists that they are just signs and manifestations of God's laws and artistry:

> *"It is not for the sun to catch up with the moon, nor does the night outrun the day. Each is travelling in an orbit of their own."*
>
> (Qur'an 36:40)

Furthermore, that all the systems of the earth and atmosphere are kept in a balance that must not be upset:

> *"And the sky He has raised high. And He set in place the Balance. That you should not tamper with this balance."*
>
> (Qur'an 55:7-8)

Alluding to the protection that the atmosphere confers:

> *"And We made the sky a protective canopy, yet they turn away from its wonders."*
>
> (Qur'an 21:32)

> *"Indeed, Earth's atmosphere isn't something we can take for granted. Without it, life as we know it wouldn't exist. Not only does it contain the oxygen we need to live, but it also protects us from harmful ultraviolet solar radiation. It creates the pressure without which liquid water couldn't exist on our planet's surface. And it warms our planet and keeps temperatures habitable for our living Earth."*
>
> (NASA Global Climate Change website)[3]

[3] https://climate.nasa.gov/news/2914/the-atmosphere-earths-security-blanket/#:~:text=Not%20only%20does%20it%20contain,habitable%20for%20our%20living%20Earth.

Limb view of Earth's atmosphere. Colours roughly denote the layers of the atmosphere
https://en.wikipedia.org/wiki/Atmosphere_of_Earth#/media/File:Sunset_from_the_ISS.JPG

The Qur'an confirms the notion that species and items do not appear spontaneously, but rather they transition through various substances and indeed forms. Depending on the reading, these are strikingly modern in their propositions:

> *"We made every living thing from water, will they not believe?"*
>
> (Quran, 21:30)

The following verses align with the big bang theory and that since then, the universe has been constantly expanding:

> *"Have those who disbelieved not considered that the heavens and the earth were a single entity, and We split them asunder."*
>
> (Quran, 21:30)

The Qur'an also seems to poetically describe the moments immediately after the Big Bang when the universe was primarily hot Hydrogen and Helium, and then started coalescing into structures:

> *"Then He directed himself to the heavens when it was smoke, and then said to it and to Earth: "Come willingly or by force" they said "We do come willingly.""*
>
> (Quran 41:11)

> *"And the heaven We constructed with might, and indeed, We are certainly expanding it."*
>
> (Quran, 51:47)

And describing the stages the embryo goes through:

> *"We created man from an extract of clay. Then We made him as a drop in a place of settlement, firmly fixed. Then We made the drop into an alaqah (leech, clinging thing, and blood clot), then We made the alaqah into a mudghah (chewed substance)…"*
>
> (Quran 23:12-14).

We now know that iron was not formed in the earth but rather came from distant supernovas and impacted the earth as it was forming. Again the Qur'an seems to concur with this notion:

> *"We sent down Iron with its great inherent strength and its many benefits for humankind"*
>
> (Quran 57:25)

The scientific mind of the Prophet (PBUH):

Disease is a natural process and requires us to search for a cure

Since time immemorial people have succumbed to the temptation to attribute supernatural causation to disease and therefore to search for supernatural cures. The Prophet (PBUH) was strictly against quackery and advised people to turn to those qualified in the worldly science of medicine, notwithstanding the element of Divine decree in whether the cure will in the end, succeed.

Jabir reported: The Messenger of God (PBUH) said,

> *"Every disease has a cure. If a cure is applied to the disease, it is relieved by the permission of God Almighty."*
>
> (Ṣaḥīḥ Muslim 2204)

Abu Darda reported: The Messenger of God (PBUH) said,

> *"Verily, God sent down the disease and the cure, and for every disease he made a cure. Seek treatment, but do not seek treatment by the unlawful."*
>
> (Sunan Abī Dāwūd 3874 Grade: Sahih li ghayrihi [authentic due to external evidence] according to Al-Arna'ut)

This stands in the face of superstitious explanations for disease e.g. at the time of the Black Death in Europe, the causes proposed were:

- God's wrath on the afflicted individual
- God's wrath on society
- 'An unusual conjunction of Saturn, Mars and Jupiter'.
- The devil and his helpers
- Poisoning by Jews, foreign beggars, etc

Must not connect natural phenomena to our life events (e.g. against astrology)

Superstition, i.e. extracting a supernatural meaning to natural phenomena, or making improbable connections between two things (omens), was a common pagan practice. Again, the Prophet insisted on a recognition that we live in a world of natural phenomena, which ultimately manifest by natural laws and are unconnected to events in our lives.

On the day of Ibrahim's death (an infant son of the Prophet), the sun eclipsed and this led many people to conclude that this phenomenon was a manifestation of God's sorrow at the death of Ibrahim. God's messenger said,

"The sun and the moon are two signs amongst the signs of God. They do not eclipse because of someone's death or life. So when you see them, invoke God and pray till the eclipse is clear."

(Bukhari Ch. 18, no. 168)

He reminded his followers that when they are struck with awe at God's artistry, this is a good time to turn to God in prayer, as the sense of awe renders the prayers more ardent.

He (PBUH) also warned,

> *"Belief in omens (Tiyarah) is paganism, and any one of us may think he sees an evil omen but God will dispel it by means of trust in Him (tawakkul)."*
>
> (Tirmidhi (1614), Abu Dawood (3910) and Ibn Majah, (3538))

The importance of seeking knowledge in Islam

Dawkins in the opening quote seemed to labour under the misperception that religion seeks to close minds, to engender a satisfaction with, indeed celebration of ignorance. Again, it would be out of place to speak for other religions, but in Islamic teachings, this could not be further from the truth. The Qur'an in fact celebrates knowledge, reasoning, questioning and the search for evidence.

- *"And say: My Lord! Increase me in knowledge."* (Qur'an 20:114)
- *"Say (unto them, O Muhammad): "Are those who know equal with those who know not?" But only men of understanding will pay heed."* (Qur'an 39:9)
- *"Only God's knowledgeable servants fear Him. Surely God is Majestic and All-pardoning."* (Qur'an 35:28)
- *"And follow not that of which you have not the knowledge; surely the hearing and the sight and the heart, all of these, shall be questioned."* (Qur'an 17:36)
- *"And they say: "None shall enter Paradise unless he be a Jew or a Christian." Those are their (vain) desires. Say: "Produce your proof if you are truthful.""* (Qur'an 2:111)
- *"God will exalt those who believe among you, and those who have knowledge, to high ranks. God is well-informed of what you do."* (Qur'an 58:11)
- To confirm all this, the Prophet (PBUH) said, "*Whoever travels a path in search of knowledge, God will make easy for him a path to Paradise."* (Ṣaḥīḥ Muslim 2699)
- As for knowledge of scripture, for those who don't know and find it difficult to learn, the Qur'an advises us not to just follow our feelings or intuition or ancient traditions, but rather: *"Ask the followers of the Remembrance if you do not know."* (Qur'an 16:43)

- There are also numerous famous sayings, which although attributed to the Prophet, cannot be authenticated, so probably just reflect the importance that Muslims placed on knowledge and learning, because they became so well-known:

  “Seek knowledge even unto China.”

  "The superiority of the scholar over the devout worshipper is like the superiority of the full moon over the rest of the heavenly bodies."

  “The ink of the learned is more sacred than the blood of the martyr.”

  “Wisdom is the lost property of the believer. Wherever he finds it, he has the greater claim to it.”

Legal reasoning

Whilst the Qur’an entreats mankind to use reason in the search for God, the majority of religious scholars hold that reason should equally be used in applying Islam’s values and teachings in finding the best solutions to people’s problems - a process called ijtihad (‘legal reasoning’). Ijtihad involves a number of legal tools such as qiyas (analogical deduction), maslahah (prioritising probable benefit) and sadd al dara’iyah (blocking routes to probable harm). In order to work out what harm or benefit is ‘probable’, a good scholar is obliged to rely on evidence, i.e. data, rather than suspicion or whim.

Ijtihad presupposes that when circumstances and societies change, interpretations should change, in order to keep the spirit of the teachings always relevant – to place the spirit of the law over the letter of the law. it is not acceptable to follow the teachings of previous generations of ‘priests’ when their pronouncements may no longer be relevant and may end up causing greater harm or even absurdities. All of this requires constant engagement of reason.

A leading jurist Ibn al Qayyim (1292-1350 CE) advised:

> “Legal interpretation should change with the change in time, place, conditions, intention and customs… ignorance of this fact has resulted in grievous injustice to the shari’ah, and has caused many difficulties, hardships and sheer impossibilities, although it is known that the noble shari’ah, which serves the highest interests of mankind, would not sanction such results.”
>
> (From I’lam al muwaqqi’een)

Science in the Islamic world

Spurred on by the prestige Islamic teachings gave to knowledge and those who investigated the natural world, as soon as the Islamic empire stabilised, emperors (caliphs) got to work patronising scholars. The first library was built by the caliph Mu'awiyah who was a companion of Prophet Muhammad (PBUH), and gathered books written in Greek, Latin, and Persian in the fields of medicine, alchemy, physics, mathematics, astrology and other disciplines. Some years later, the technique for paper making was acquired from the Chinese, which made the sharing of knowledge a whole lot easier.

130 years after the passing of the Prophet, in 762 CE, the recently established Abbasid empire founded a new capital, Baghdad. There they built a research institute, called the House of Wisdom, which handsomely paid scholars and translators to translate Greek, Syrian and Persian scientific texts to Arabic. The House received a massive boost in support and funding by the learned Caliph, Al Ma'mun who took a personal interest in the progress of the institute, visiting it regularly and arranging debates there.

Scholars at the Abbasid library by Yahya ibn Mahmud al-Wasiti, 1237

https://upload.wikimedia.org/wikipedia/commons/2/2c/Maqamat_hariri.jpg

We saw how Islamic teachings demand that facts must be substantiated. So, though impressed by the extensive learning and hypothesising of the Greeks, Muslim scientists scrutinised their theories and checked them against the outcomes of experiments. Scholars were often polymaths. They were learned in Islamic teachings from an early age, memorising the entire Qur'an and some religious texts before going onto study medicine and other scientific works and then spending a life reflecting, investigating and authoring books.

Though not wholly connected to science, it is interesting that Aristotle had such an impact on the Muslim world. He spoke of the importance of learning grammar, rhetoric and logic and consequently, these three subjects became part of the core curriculum in Islamic universities even though they were not given particular attention in scripture. Medieval Europe also embraced these three subjects as an essential part of the liberal arts, known as the 'trivium'.

Greek learning included mathematics, ethics and scientific and metaphysical ideas. At the time, these were all bundled together into the term 'philosophy'. Some metaphysical notions did not align with Islamic theology, such as the Greek belief in the eternity of the universe, so at one point there was a move against 'philosophy', seeing it as an innovation, impiety, even heresy, despite the fact that by 'philosophy' many Islamic scientists simply meant 'science' – the term science only emerged in Europe in the 1800s – before that it was just known as philosophy, or more specifically, 'natural philosophy'.

The Spanish scholar Ibn Rushd Latin: Averroes, born 1126 CE), became famous in the Muslim world for his theological work investigating the differences between the Islamic juristic schools (Bidayat Al Mujtahid), but was perhaps more famous in Europe, where he was nick-named 'the Commentator' because, patronised by the Muslim Spanish king, he produced extensive commentaries on the works of Aristotle. Here this great Islamic authority, Ibn Rushd defends 'philosophy', in the sense of reason and science, arguing that scientific enquiry could even be seen as a religious obligation:

> "We maintain that the business of philosophy is nothing other than to look into creation and to ponder over it in order to be guided to the Creator - in other words, to look into the meaning of existence. For the knowledge of creation leads to the cognizance of the Creator... The more perfect becomes the knowledge of creation, the more perfect becomes the knowledge of the Creator. The Law encourages and exhorts us to observe creation.
>
> Thus, it is clear that this is to be taken either as a religious injunction or as something approved by the Law. But the Law urges us to observe creation by means of reason and demands the knowledge thereof through reason. This is evident from different verses of the Qur'an.

For example, the Qur'an says: "Wherefore take example from them, you who have eyes" [Qur'an 49.2]. That is a clear indication of the necessity of using the reasoning faculty, or rather both reason and religion, in the interpretation of things.

Again it says: "Or do they not contemplate the kingdom of heaven and earth and the things which God has created" [Qur'an 7.184]. This is in plain exhortation to encourage the use of observation of creation. And remember that one whom God especially distinguishes in this respect, Abraham, the prophet. For He says: "And this did we show unto Abraham: the kingdom of heaven and earth" [Qur'an 6.75]. Further, He says: "Do they not consider the camels, how they are created; and the heaven, how it is raised" [Qur'an 88.17]. Or, still again: "And (who) meditate on the creation of heaven and earth, saying, O Lord you have not created this in vain" [Qur'an 3.176]. There are many other verses on this subject: too numerous to be enumerated.

Now, it being established that the Law makes the observation and consideration of creation by reason obligatory - and consideration is nothing but to make explicit the implicit - this can only be done through reason. Thus, we must look into creation with reason. Moreover, it is obvious that the observation which the Law approves and encourages must be of the most perfect type, performed with the most perfect kind of reasoning. As the Law emphasizes the knowledge of God and His creation by inference, it is incumbent on any who wish to know God and His whole creation by inference, to learn the kinds of inference, their conditions and that which distinguishes philosophy from dialectic and exhortation from syllogism...

One cannot maintain that this kind of reasoning is an innovation in religion because it did not exist in the early days of Islam. For legal reasoning and its kinds are things which were invented also in later ages, and no one thinks they are innovations. Such should also be our attitude towards philosophical reasoning."

(Ibn Rushd, Introduction to *On the Harmony of Religions and Philosophy*, in Arabic Kitab fasl al-maqal)

Statue of Averroes in Córdoba, Spain

https://en.wikipedia.org/wiki/Averroes#/media/File:Statue_of_Averroes_in_C%C3%B3rdoba,_Spain.jpg

The Scientific method and other dazzling discoveries

So where did this spirit of free enquiry lead Muslim scientists, whose time was eagerly funded by kings and emperors?

There are so many but arguably the greatest contribution is the scientific method itself. We mentioned earlier that Greeks were famous for observing nature and then deriving ideas on the basis of their observations – i.e. deduction. These theories can seem impressive but what would happen if the theories were actually put to the test? The tradition of testing ideas through experimentation is the unique contribution of Muslim scientists.

Ibn Al Haytham (Latin Alhazen, born 965 CE) was a prolific writer. According to his own testimony, he wrote 25 works on mathematical sciences, 44 works on (Aristotelian) physics and metaphysics, also on meteorology and psychology. However, what he is remembered for is optics and the scientific method.

Alhazen spent many years investigating light and optics. Greeks had theorised that vision occurred by light emitted from the eyes coming into contact with objects but following careful experimentation, Ibn Al Haytham was the first to prove that it is light reflecting off objects that is picked up and sensed by eyes.

Illustration from System der visuellen Wahrnehmung beim Menschen (1687) depicting emission theory.
https://upload.wikimedia.org/wikipedia/commons/e/ea/Fotothek_df_tg_0001920_Optik_%5E_Anatomie_%5E_Mensch_%5E_Auge.jpg

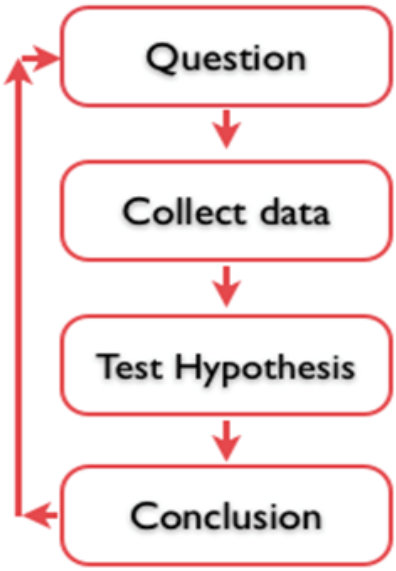
He developed a scientific method very similar to our own, combining observations, experiments and rational arguments to support his theories. He employed scientific skepticism (Questioning experiments and there methods, whether the result is due to the experiment or another factor) and emphasised the importance of empiricism and criticised Aristotle for his lack of contribution to the method of induction (as opposed to deduction), which Ibn al-Haytham regarded as superior, and he considered induction to be the basic requirement for true scientific research.

He argued that if instruments produce errors because of their imperfections or idiosyncratic qualities, then multiple observations must be taken, analysed qualitatively, and on this basis, arrive at a *"common-sense single value for the*

constant sought", whether an arithmetic mean or a *"reliable estimate."* This method ensured his results were highly specific and accurate.

In his scientific method, *"universals came out of practical, experimental work"* and *"theories are formulated after discoveries"*, as with inductive reasoning.

He urges:



"Therefore, the seeker after the truth is not one who studies the writings of the ancients and, following his natural disposition, puts his trust in them, but rather the one who suspects his faith in them and questions what he gathers from them, the one who submits to argument and demonstration, and not to the sayings of a human being whose nature is fraught with all kinds of imperfection and deficiency.

The duty of the man who investigates the writings of scientists, if learning the truth is his goal, is to make himself an enemy of all that he reads, and ... attack it from every side. He should also suspect himself as he performs his critical examination of it, so that he may avoid falling into either prejudice or leniency."

In medieval Europe, Muslim scholars were well known in educated circles. For example, in the introduction (General Prologue) of the Canterbury tales (1387-1400), Chaucer describes the qualities of the capable doctor, and then lists his credentials by the books he was versed in:

429 **Wel knew he the olde Esculapius,**
He well knew the old Aesculapius,
430 **And Deyscorides, and eek Rufus,**
And Dioscorides, and also Rufus,
431 **Olde Ypocras, Haly, and Galyen,**
Old Hippocrates, Haly (Ali Al Majusi), and Galen,
432 **Serapion, Razis, and Avycen,**
Serapion, Rhazes (Al Razi), and Avicenna (Ibn Sina),
433 **Averrois, Damascien, and Constantyn,**
Averroes (Ibn Rushd), John the Damascan (Al Dimashqi – a Christian Arab), and Constantinus Africanus (a Muslim doctor who converted to Christianity when he took refuge in Italy),
434 **Bernard, and Gatesden, and Gilbertyn.**
Bernard, and Gaddesden, and Gilbertus.

435 **Of his diete mesurable was he,**
He was moderate in his diet...

Here are just a few examples of other Muslim scientists and their contributions:

Al-Jahiz (born 766 CE)

Zoologist who first described natural selection and evolution:

"Animals engage in a struggle for existing, and for resources, to avoid being eaten, and to breed... Environmental factors influence organisms to develop new characteristics to ensure survival, thus transforming them into new species. Animals that survive to breed can pass on their successful characteristics to their offspring."

Al-Jahiz, Book of the Animals (Kitab al Hayawan)

A page from a reproduction of al-Jāḥiẓ's Kitāb al-Hayawān depicting an ostrich (Struthio camelus) in a nest with eggs

https://en.wikipedia.org/wiki/Al-Jahiz#/media/File:Syrischer_Maler_um_1335_001.jpg

Jabir Ibn Hayyan (Latin: Geber, born 700s CE)

'Father of chemistry'. Invented many chemical instruments and classification of chemicals, also how to extract an inorganic substance (ammonium chloride) from organic material.

Al Khwarizmi (Latin: Algaurizin born 780 CE)

Scientist at the House of Wisdom

Introduced Hindu-Arabic numeral system to Europe (400 years later), devised the decimal system and invented Algebra (al-Kitāb al-mukhtaṣar fī ḥisāb **al-jabr** wal-muqābala)

Ibn Ishaq Al Kindi (Latin: Alkindus born 801 CE)

Scientist at the House of Wisdom

Introduced Hindu numerals to the Islamic world.

Father of cryptography, earliest use of statistical inference

Used statistics to measure effectiveness of medical treatments

Described how weather fronts are created by the heating of air and its movement to cooler areas

Abu Bakr Al-Razi (Latin: Rhazes born 865 CE)

Discovered that diseases can be air-born.

First described the difference between measles and small pox

From extensive observations and research he criticised many of the assumptions that the great Greek physician Galen had made (in his book 'Doubts about Galen' – Al Shukuk 'ala Jalinus)

Challenged the prevalent

Challenged the prevalent view that the body possessed four 'humours' and that substances are 'warm' or 'cold' in nature.

Wrote on medical ethics:

> “The doctor's aim is to do good, even to our enemies, so much more to our friends, and my profession forbids us to do harm to our kindred, as it is instituted for the benefit and welfare of the human race, and God imposed on physicians the oath not to compose mortiferous remedies.”

Depiction of al-Razi in a 13th-century manuscript of a work by Gerard of Cremona

https://en.wikipedia.org/wiki/Abu_Bakr_al-Razi#/media/File:Al-RaziInGerardusCremonensis1250.JPG

Ammar ibn Ali Al-Mawsili (born 900s CE)

Invention of a hypodermic syringe, which he used to remove cataracts, a major cause of blindness

> "Then I constructed the hollow needle, but I did not operate with it on anybody at all, before I came to Tiberias. There came a man for an operation who told me: Do as you like with me, only I cannot lie on my back. Then I operated on him with the hollow needle and extracted the cataract; and he saw immediately and did not need to lie, but slept as he liked."

Abul Qasim Al-Zahrawi (Latin: Albucasis born 936 CE)

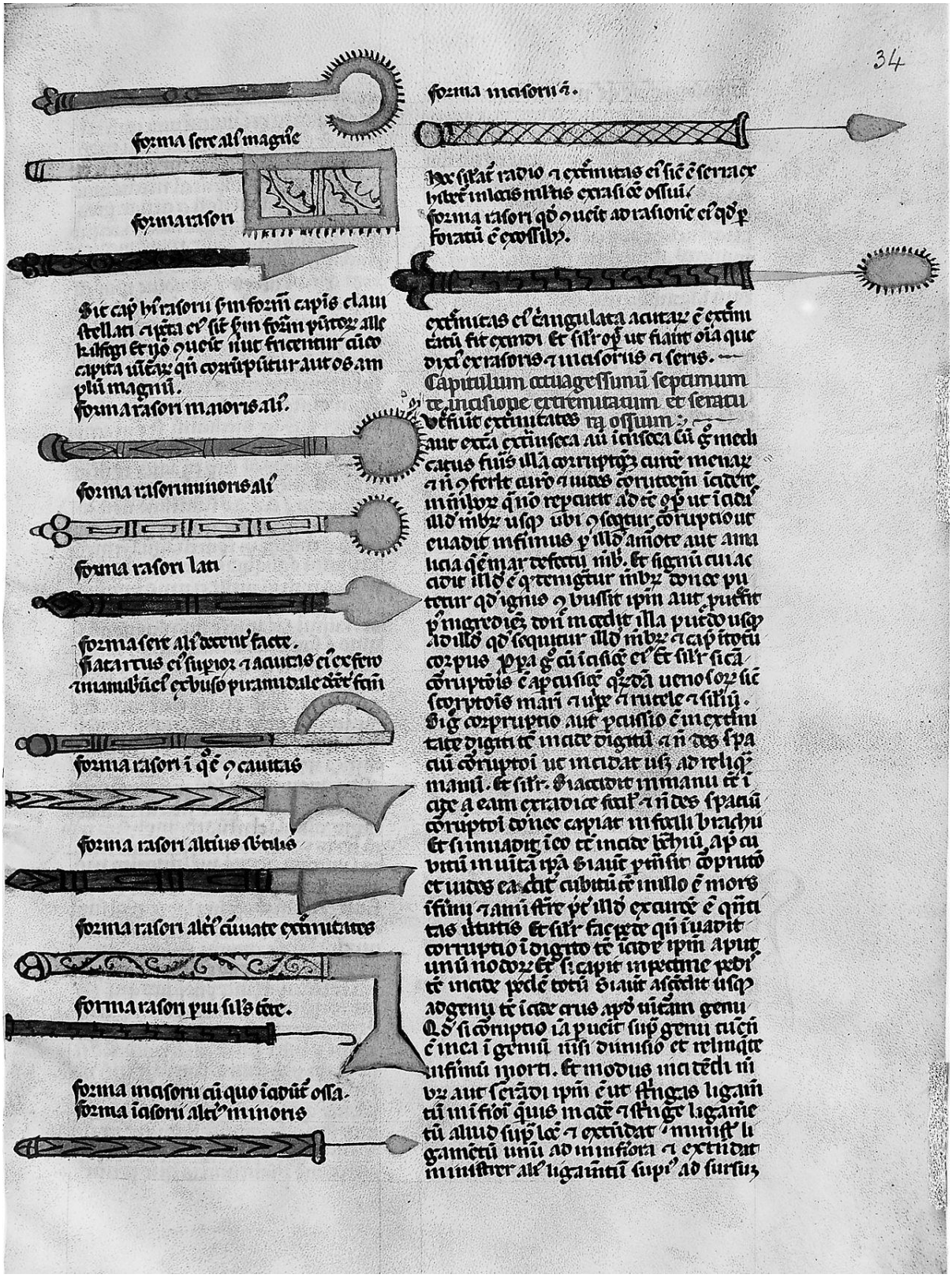
Famous surgeon, invented 200 surgical instruments.

First used catgut for medical stitching in internal surgery – continues to be used today.

Invented a keyhole technique for breaking bladder stones without major surgery.

Spoke of importance of good anatomical knowledge before you can operate:

> “Before practicing surgery one should gain knowledge of anatomy and the function of organs so that he will understand their shape, connections and borders. He should become thoroughly familiar with nerves muscles bones arteries and veins. If one does not comprehend the anatomy and physiology one can commit a mistake which will result in the death of the patient. I have seen someone incise into a swelling in the neck thinking it was an abscess, when it was an aneurysm and the patient dying on the spot.”



Chirurgia Albucasum - translated into Latin by Gerard of Cremona, manuscript dated from the early 14th Century

https://en.wikipedia.org/wiki/Al-Zahrawi#/media/File:Albucasis,_Chirurgia_Albucasum._Wellcome_M0004103.jpg

Ibn Sina (Latin: Avicenna born 980 CE)

Compiled a canon of medicine (Al Qanun) which was in use by European doctors for centuries

Also advanced a sophisticated cosmological proof of God, which endured for centuries in the East and West

Ali Al Majusi (Latin: Haly born 982 CE)

Wrote a famous medical text 'The Complete Book of the Medical Art'. Described the importance of a doctor patient relationship, medical ethics, and psychosomatic medicine – the connection between a well mind and bodily wellness.

Discovered capillary system, that the uterus contracts to expel babies, provided details of the scientific methodology.

Al-Biruni (Latin: Alberonius born 973 CE)

Devised the hydrostatic balance to determine the density of various substances, including air. His work on density was used by Galileo and Newton.

Considered the first anthropologist.

Worked out the surface area of the earth and the areas of Africa and Eurasia and concluded there must be another continent west of Europe.

Ibn al-Nafis (born 1213 CE)

First to challenge Galen and correctly describe pulmonary circulation of blood (ceturies before Harvey, who we assume was the first to .

Described coronary circulation

Ibn al-Nafis was also one of the few physicians at the time, who supported the view that the brain, rather than the heart, was the organ responsible for thinking and sensation.

Ibn al-Nafis is also credited with providing the earliest recorded reference for the concept of metabolism:

"Both the body and its parts are in a continuous state of dissolution and nourishment, so they are inevitably undergoing permanent change."

The elephant and the Enlightenment

Are you sensing that there's an elephant in the room? Yes, that's right. Why, despite all the dazzling discoveries of Muslim scientists and their writings being so ubiquitous in medieval Europe that most acquired Latin nicknames, are they mostly forgotten today? Are they ever mentioned in GCSE science lessons or even RE? Why is it that the only names from recent history well known for their scientific work, are Europeans?

And when you look, most of the discoveries took place about a thousand years ago. Why did the light of Islamic scientific enquiry go out and why did science move to the West, where it flowered like never before?

There are numerous possible reasons, and each are open to debate but I'll simply list them, rather than indulging on the to and fros of the debates. For what cannot be debated is that the ardent pursuit of science fizzled out in the Muslim world and that it really took off in Europe, from the 1600s onwards. And so there must be a reason, or a group of reasons for this. So what are they?

Destruction of libraries and empires that supported science.

Two great centres of learning were Baghdad in the East and Cordoba in the West. Both fell and were largely destroyed with the complete destruction of the libraries and universities.

Baghdad fell to the Mongols in 1258 and the city was largely destroyed, with the slaughter of men, women and children. The books of Baghdad's great library were thrown into the River Tigris, until the water went black with the flow of ink, whilst the leather binding was stripped off to make sandals. The books piled so high in the river that they mound formed a bridge across the river.

Cordoba, the jewel of Muslim Spain, fell to Christian forces in 1236. In its heyday private libraries flourished so much so that Muslim Cordoba had sported the largest book library in Western Europe (Harris, History of Libraries in the Western World 4th ed [1999] 81). After the Christian Reconquista, at one point, Arabic books were piled high in each Spanish city and put to the flame. Before the printing press, the loss of a book sometimes meant the loss of the only copy of that manuscript. Vast numbers of books by the scholars of Islamic heritage are known only in reference, with no existing copy surviving today.

Much more could be said about the greatness of these kingdoms at their zenith, but in order for them to fall, and particularly the Abbasid Caliphate to the Mongol hordes, they must have been, and indeed were, already in descent. For perhaps one or two hundred years prior, larger empires had broken down into smaller statelets, with their coffers distracted in funding war with neighbouring fiefdoms or paying for the sensuous indulgences of the courts, losing interest in patronising scientists.

Islam and science in the modern era

The past two to three centuries have been tumultuous for the Muslim world. Stagnating in science and technology, more and more parts of the world were colonised by European powers leaving the populations to existential crisis. Whilst Christianity could hold no appeal, as secular nationalist ideas took hold in Europe near the end of the 1800s, European learning coupled with these philosophies impressed large numbers of young, educated Muslims.

These values seemed at odds with traditional learning and it must have felt like an intelligent person at the time would be forced to turn one way or the other. Into this turbulence arose a series of controversial figures whose ideas eventually pervaded the population.

For instance, the enigmatic agitator, Jamaluddin Al Afghani (1839-1897) travelled the Muslim world, berating the religious establishment for turning their back on their heritage of scientific enquiry and at the same time arguing that there was no hope of uniting and fighting colonialism without embracing science and the advancements of the modern world. He was impressive in many languages and won the trust and later suspicion of a number of governments, all the while, influencing the colonised masses.

Here he advises the Muslim youth:

> “O, sons of the East, don’t you know that the power of the Westerners and their domination over you came about through their advance in learning and education, and your decline in these domains?... Are you satisfied after your past achievements, after you had reached the acme of honour through learning and education, to remain in that wretched state into which you were plunged by ignorance and error. ...Make the effort to obtain knowledge and become enlightened with the light of truth so as to recoup glory and obtain true independence.”

(Jamal Ad-Din Afghani: A Pioneer of Islamic Modernism, Malik Mohammad Tariq, the Dialogue 2011, VI no.4, p.354)[4]

Al Afghani, along with his student, Muhammad 'Abduh (1849-1905) together published a highly influential magazine from Paris, 'The Trusty Handhold'. 'Abduh was a leading religious scholar and philosopher and became rector of the leading Sunni University, Al Azhar in Cairo. There he instituted a modernising programme to the curriculum. He demonstrated the arguments of Al Afghani by interpreting the Qur'an in light of scientific knowledge. Their interests in modernising education, overlapped with the objectives of colonising powers in the Muslim world, as well as nationalists, despite them each having opposing political aspirations. As a result of the convergence of many forces, by the mid 20th century, mainstream education for all students showing promise throughout the Muslim world, had become a curriculum not that different from that of Europe or America.

Another notable Egyptian anti-colonialist was Hasan Al Banna, the founder of the Muslim Brotherhood who was influenced by 'Abduh and his protégé, Rashid Rida. His ideas, like those of his predecessors, emphasised respect for Islamic values whilst respecting and embracing scientific knowledge. Gaining millions of followers in a few, short years, he had a lasting impact on 20th century Muslim attitudes to science. As an activist, he had little time for writing books but did write a number of pamphlets for his followers, who mainly hailed for the western educated elites.

This is what Hassan Al Banna taught his followers in the pamphlet, 'Message of the Teachings' in a 20 point section called 'Understanding':

> "18. Islam liberates the mind, urges contemplation of the universe, honours science and scientists, and welcomes all that is good and beneficial to mankind: 'Wisdom is the lost property of the believer. Wherever he finds it, he is more deserving to it.'
>
> 19. Islamic principles may be evident or uncertain, as are pure scientific principles. The evident principles of the two classes will never conflict; that is, it is impossible for an established scientific fact to contradict an authentic Islamic principle.
>
> However, this may happen if one or both of them are uncertain. If one of them is uncertain, then it should be reinterpreted so as to remove the contradiction If both are uncertain, then the uncertain Islamic principle

[4] https://qurtuba.edu.pk/thedialogue/The%20Dialogue/6_4/Dialogue_October_December2011_340-354.pdf

should be given precedence over the uncertain scientific notion until the latter is proven."

Jamat-e-Islami was a comparable 20th century anti-colonial movement but with its origin and impact in the Indian subcontinent. It also reached out to young Muslims who had been taught through the modern educational system and emphasised scientific learning and reconciling it with a strong faith in Islam.

These ideas, though initially controversial have been through a turbulent journey but eventually prevailed so much so that now, most educated Muslims have no hold ups about learning and teaching science whilst holding onto their faith.

Science, globalisation and AI

Learning about the natural world, devising tools to help, such as mathematics (accepting that maths is more than that) and then harnessing the potential from that knowledge, are all part of our long journey of advancement. This knowledge belongs to all humanity. It is 'open source' - technically, you cannot apply a regional, cultural or religious label to human learning. People do, but doing so is immature and reflects a blindness to the broad sweep of human history.

Human beings have been around for over a hundred thousand years. Why is it that most of our advancements in science have only occurred in the past three thousand years, and despite fits and starts, scientific knowledge appears to follow something like an exponential trajectory?

We must conclude that discoveries need to be incubated in 'perfect sociocultural conditions'. From what has already been mentioned, we can offer a good guess at what these are:

- The shoulders of giants - scientist have to benefit from the vantage point of previous knowledge to direct future discoveries from. So, in the past that meant libraries, universities, teachers.
- Patronising - great minds will be forced to hunt woolly mammoths, till the fields and die early, unless they can be freed up to pursue a life of reading, reflecting, experimenting and writing.
- Peace - great minds cannot set to work on science of they're distracted by war and instability and their institutions and books are being destroyed all the time.

- Cultural freedom – a cultural environment where free thinking and challenging tradition is respected and not penalised (e.g. late Greek antiquity, early Islamic civilisation and enlightenment Europe).

We have seen that given the opportunity, civilisations learnt from one another and all the while, progressed in knowledge. Greeks, for the last 500 years BCE, then a relative quiet of a few centuries (although significant progress was occurring in India), there was a further explosion of learning in the Muslim world around 1000 CE and then the baton was seized by Christian Europe about 500 years later.

Today we have moved to a truly wondrous phase because knowledge is now global, and collaborations for research often include people from all over the world, bringing with them a diversity of religion and culture. In our time science and technology go hand in hand, in a way that just didn't happen hundreds of years ago. In fact science is stepping beyond humanity as AI progresses discoveries at breakneck speed. Who knows what the future holds? All we can be sure of, is that we will have a radically different tomorrow that will perhaps appear even more perplexing to us than our present time would seem, to a person from five hundred years ago.

We have taken a long view of the exploration of God's signs, the search for the Truth about how this amazing universe works and came into being. Though important, this is not the sole purpose of humanity, for science has been used for destruction at times too. Religions provide human beings with a bigger picture, the opportunity to see this life and eternity as a comprehensive whole, to transcend the potential tragedy of the human condition and find purpose and motivation to live the good life. It would be apt therefore, to close with the Qur'an's chapter on time.

> *"By the token of time through the ages*
> *Indeed humanity is in a state of loss*
> *Except those who believe, do good and enjoin one another to the truth*
> *and enjoin one another to patience and determination."*
>
> (Qur'an, Sura 'Asr 103:1-3)