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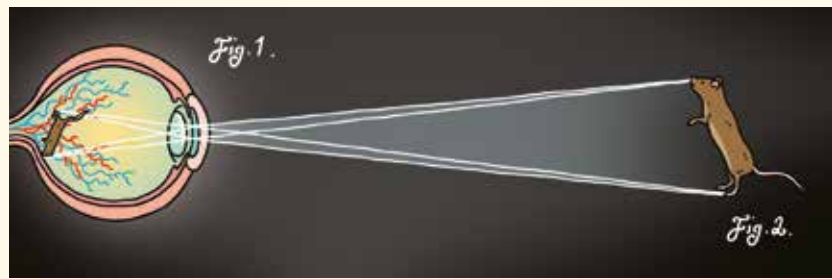
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Unlocking the scientific secrets of sight

FROM OUR MAN IN THE MAGHREB, Cairo, 1021

IMAGINE A TECHNOLOGY that would allow humans to zoom in so they could see the Moon and stars close up – as if they were in space! The scientist Ibn al-Haytham believes one day such a technology may be possible.

In his recent *Book of Optics*, the Muslim scholar puts forward a new theory explaining the science of how people see. Scholars believe his ideas may one day lead to the development of techniques for viewing distant objects, perhaps even the stars, close up.



Mr al-Haytham disagrees with the classical philosophers Euclid and Ptolemy, who argued that our eyes shoot out particles of light that illuminate objects, allowing us to see them. Instead, he says some objects reflect light from the Sun while others absorb it. Either way, the light that reaches our eyes is

what creates the images we see. He points to the implausible notion that the eyes could light up an area as big as the night sky when they are open; it is much more likely, he says, that the Sun, Moon and stars are shining down on us.

Mr al-Haytham also discusses the concept of magnification, which has

excited many scientists. Using this technique, he believes it will one day be possible to bend light so that objects look closer. Scholars hope that it might also be employed for viewing distant, mysterious objects or observing tiny creatures in fine detail.

Mr al-Haytham began his career as an engineer in Cairo, working for the Caliph. He started experimenting with optics after the failure of a huge project to control the flooding of the River Nile. After avoiding the Caliph's wrath, by pretending to be mad, Mr al-Haytham was able to focus his curiosity on the scientific investigations that have led to his groundbreaking *Book of Optics*.

House of Wisdom leaves Europe in dark

Baghdad becomes new seat of learning after caliphs order translation of ancient texts

BY OUR MIDDLE EAST EDITOR, Baghdad, 1025

THE REDISCOVERY of ancient Greek and Roman wisdom is spurring new discoveries in medical and scientific thought throughout the Middle East. While much of Europe has been prey to intellectual drought since the fall of the Roman Empire, scholars across the Muslim world are busily translating, studying and developing ideas based on these classical ancient texts.

In Baghdad, a scholarly institution supported by the caliphate known as the House of Wisdom is now one of the largest repositories of knowledge from the ancient world. Since the introduction of convenient, affordable papermaking techniques from China, the caliphs have commissioned the translation of hundreds of texts into Arabic, ensuring that the study of science is a priority under their rule.

The works of Greek philosopher Aristotle were amongst the first to be translated, and his philosophy is now basic reading for all Muslim scholars.

Earlier this year, a doctor from Persia called Avicenna announced the release of his fourteen-volume *Canon of Medicine*. This encyclopaedia draws upon the discoveries and ideas of Aristotle and Galen to investigate the body and its various illnesses. It also details suggestions for healing and maintaining good health.

Mr Avicenna believes that exercise is key to healthy living, helping to stave off disease. He also provides information on how plants and herbs can be used as painkillers, medicines or even contraceptives.

Mr Avicenna says rigorous testing must be carried out before using any new drug or medicine. Perhaps most importantly, Mr Avicenna says new drugs should be tested on humans, not just animals, since he believes that what is good for an animal is not necessarily good for a human.

Mr Avicenna's discoveries about the human body are already being taught in libraries and schools across the Muslim world.

Other Greek, Roman, Persian and Indian works have also been translated



and spread across the Arab world, leading to the rise of other centres of Muslim scholarship, for example in Córdoba in Andalucía. Here a rival government to the rulers of Baghdad was established in 756 by Abd ar-Rahman, a prince of the deposed Umayyad royal family who refused to recognise the authority of the Abbasid caliph in Damascus.

New irrigation techniques are now being deployed across Iberia to improve harvests and enable the cultivation of new crops such as watermelons, rice and bananas. Commentators consider that ever since the collapse of the Roman Empire in the fifth century AD, Christian Europe has been left far behind the Muslim world in terms of scientific understanding.

Bleeding and plants are keys to healthy life

BY OUR MEDICAL EDITOR, Bingen, Germany, 1150

A VISIONARY female theologian, the poet and scientist Hildegard of Bingen, has just completed a new work on the human body and its ailments. The work promises to help alleviate many of the world's most pernicious afflictions and diseases.

Ms Hildegard has already proved her ample knowledge of the natural world in *Physika*, a work that focuses on the medicinal properties of plants, minerals and animals. Ms Hildegard's latest work, *Causes and Cures*, lays out her specialist medical and anatomical thinking.



In her work, Ms Hildegard recommends 'bleeding' a patient as a cure for many conditions. This technique, which involves letting bad blood flow out, has been in use since ancient Greek times, but Ms Hildegard describes in great detail how it should be done, including how much blood to take and even which phase of the Moon it should be performed under. She also presents remedies for burns, fractures, dislocations and cuts.

Ms Hildegard's strong belief is that since everything was put on Earth by God for humans to use, it is no wonder that cures for a wide variety of diseases can be found in various plants and minerals. In her book, Ms Hildegard has developed a classification system for all the organisms mentioned in the *Book of Genesis*.

Ms Hildegard says her inspiration has come from a series of visions that she has experienced throughout her life, as well as through the five senses – sight, hearing, taste, smell and touch – all of which she claims are gifts from God.

Renaissance man says fossils no proof of Biblical flood

BY OUR RESIDENT POLYMATH, Monte Rosa, Switzerland, 1510

WHAT'S A FOSSIL? The origin of these strange shapes found in rocks around the globe is a mystery that has long puzzled scientists. Often they take the shape of animals and plants not found living on the Earth, seemingly frozen in time. Now a new explanation has been proffered by the celebrated Italian polymath, Leonardo da Vinci.

Mr da Vinci has dedicated much of his professional career to drawing diagrams for bizarre inventions such as helicopters, steam-powered cannons and mechanical soldiers. Now he has turned his curiosity to the natural sciences, observing birds in order to design his own flying machines and, through fossils, studying the ancient history of the Earth itself.

Perplexed by the many fossilised marine molluscs that are found high in the Alps bordering Switzerland and Italy, Mr da Vinci has pondered how these sea creatures came to be so far from water. Two common explanations exist: that a great flood sent by God submerged the mountains; or that these are formations that have simply grown in the rocks. Mr da Vinci disagrees with both theories.

"A worldwide flood is quite simply an impossibility," he says dismissively. "Where did all the water go? And as

for these being an ordinary feature of the landscape, one can clearly see from the distinct layers of rock, which are laid down throughout Earth's life, that these creatures appear only at a certain time in history and bear a similarity to fossils found by the coasts."

Mr da Vinci maintains that these mountains were not always mountains – long ago this was an area of coastline or ocean, now raised high. In his view, fossils provide evidence to suggest that the Earth's shape is constantly changing.

Mr da Vinci has also been studying human anatomy, even creating the first study of a foetus in the womb, all to help him improve his painting.

"As an artist," he says, "understanding the skeleton and muscles to draw realistic figures is just as important as it is for a doctor to give the proper medicine. I have been working with physicians across Italy to create detailed drawings of the human body that will not only inform my work but also, I hope, further medical knowledge."



Dissections reveal body's secrets

THE GRUESOME DISSECTION of a human corpse took place yesterday in Basel, Switzerland, when radical surgeon Andreas Vesalius invited the public to watch him explain the inner workings of the human body. Mr Vesalius cut open the cadaver of local criminal Jakob Karrer von Gebweiler, preserving the skeleton for public display, writes our medical editor from Switzerland on 13 May 1543.

Mr Vesalius claims that dissecting humans, which is a long-standing taboo in many European countries, is a necessary technique for the proper study of anatomy. The Belgian surgeon hit the headlines two years ago when he pointed out that the anatomical

works of the Greek physician Galen, long considered the ultimate authority, are based on flawed animal dissections.

In Mr Galen's time, the Roman Empire banned all dissection of human bodies but now, although controversial, such research is permitted. Thanks to his human dissections, Mr Vesalius has identified errors in Mr Galen's work.

For example, he has found that human jawbones are made of one hinged bone, not two as proposed by Mr Galen. As a result of Mr Galen's failings Mr Vesalius is now sceptical of relying too heavily on the classical thinkers, feeling that their lack of carefully repeated examination, and their merging of philosophy and medicine, has led to serious mistakes.

Mr Vesalius has also debunked some common misunderstandings about the body, including the belief that men have one rib fewer than women, a myth originating with the story of Adam and Eve. Mr Vesalius plans to publish his discoveries accompanied by detailed illustrations.



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PERMIAN A fourth mass extinction: species die off for many reasons, but the main one is thought to be the impact of a meteorite. The Permian-Triassic extinction is the most severe, with 96% of species disappearing. This is the only time that dinosaurs are known to have existed.

TRIASSIC Mammals evolve in a world dominated by dinosaurs. The first mammals are small, shrew-like creatures that live in the shade of the trees. They are the only mammals to survive the Permian-Triassic extinction.

JURASSIC A fourth mass extinction: species die off for many reasons, but the main one is thought to be the impact of a meteorite. The Jurassic-Triassic extinction is the most severe, with 96% of species disappearing. This is the only time that dinosaurs are known to have existed.

CRETACEOUS The first flowering plants appear. The first dinosaurs are known to have existed. The Cretaceous-Tertiary extinction is the most severe, with 96% of species disappearing. This is the only time that dinosaurs are known to have existed.

PALEOGENE The first mammals are known to have existed. The Paleocene-Eocene extinction is the most severe, with 96% of species disappearing. This is the only time that dinosaurs are known to have existed.

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QUATERNARY The first mammals are known to have existed. The Quaternary-Tertiary extinction is the most severe, with 96% of species disappearing. This is the only time that dinosaurs are known to have existed.

MODERN The first mammals are known to have existed. The Modern-Tertiary extinction is the most severe, with 96% of species disappearing. This is the only time that dinosaurs are known to have existed.

DIAPYCNUS A primitive fern that grows in the shade of the trees. It is the only fern to survive the Permian-Triassic extinction.

SELAGES These plants are the first to have evolved. They are the only plants to survive the Permian-Triassic extinction.

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