

The well-spring

About 3,000 years ago, the Greeks invented science.

Lewis Wolpert

In reflecting on and enjoying the scientific triumphs of the past millennium, we should also honour the origins of science and give grateful thanks to the Greek scientists of the millennium before Christ. There is no earlier society in which one can identify science as distinct from technology, and where there was an objective attempt to explain the way the world works. The Chinese — who had a magical view of the Universe — were quite different.

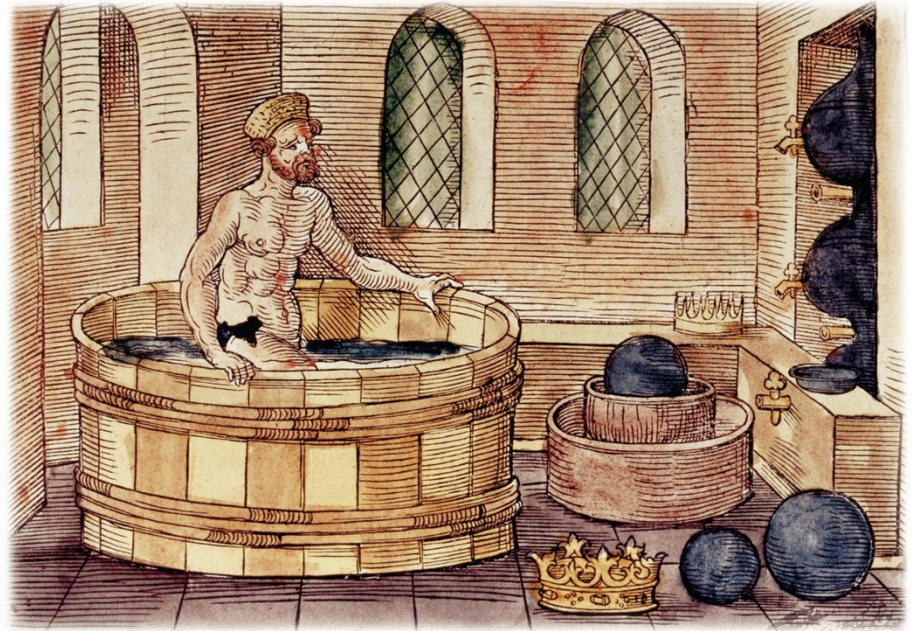
In particular, it was the Greeks of Ionia who were the first to attempt to explain the world in concrete terms as distinct from mystical ones. They held the belief that there were general laws that could be discovered, and the conviction that rational argument was essential.

Science is not a natural mode of thought, as the world is not built on the expectation that we gain from our everyday experiences. The Greeks stood back from nature and tried to understand it for its own sake; indeed, as the historian of Greek science Geoffrey Lloyd has suggested, they may even be thought of as having invented the idea of nature. Understanding was to be its own reward.

This process is beautifully illustrated by the first record of a scientific theory, that of Thales of Miletos. In about 600 BC, Thales suggested that everything was made of water in different forms. Water could change its form from solid to liquid and back again, and water was essential for life. This is a fantastical suggestion, against all common sense, but clearly a scientific theory that could be tested. The possibility of objective and critical thinking — and, crucially, open debate — about nature had begun. Anaximander, for example, strongly disputed Thales' claim about water and instead proposed air as the key substance.

Although Thales has the honour of being the first person to do real science, we must also recognize that he was almost certainly aware of earlier achievements in mathematics, particularly those of the Egyptians and Babylonians. Yet it was Thales who first made formal mathematical statements such as: a circle is bisected by its diameter. And: if two straight lines intersect, the opposite angles are equal. Hence he laid the foundations for geometry and Euclid.

My hero among the Greeks is Archimedes, who followed in the footsteps of Aristotle and Euclid by stating postulates and then deducing the logical and formal consequences. In mechanics, he invented the



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concept of the centre of gravity and provided a geometrical proof that two bodies of different sizes placed on a simple balance will be in equilibrium at distances reciprocally equal to their weights. Even today, it is non-trivial for a physics student to arrive at such a proof. Archimedes also created hydrostatics. Just consider the achievement of his second postulate: "Let it be granted that bodies which are forced upwards in a fluid are forced upwards along the perpendicular to the surface which passes through their centre of gravity."

From such postulates Archimedes showed that a body's loss of weight in a fluid is equal to the weight of water that it displaces, and went on to discover the specific gravity of substances. To those who insist that scientific knowledge is transitory and continually replaced, his work is an elegant rebuttal. He is the first true mathematical physicist and applied mathematician, and no one else made any progress in his area for another one and a half millennia. No wonder Galileo called him "divine".

The Greeks had a society in which there

was vigorous debate and discussion of evidence. It is also the first society where an individual author explicitly distances himself from the received tradition and criticizes it, and even claims originality for himself. The admiration of one's peers is one of the major rewards of science; in Greece this practice first became possible, as authors adopted the first-person singular for the first time in history. Perhaps this had its origin in the demand for recognition by the Greek poets and the Greek tradition in examining evidence in the context of law and politics. The success of science depends on our having inherited this openness and the right to challenge authority. This truth should be forcibly pointed out to those who wish to constrain scientific investigations. ■

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