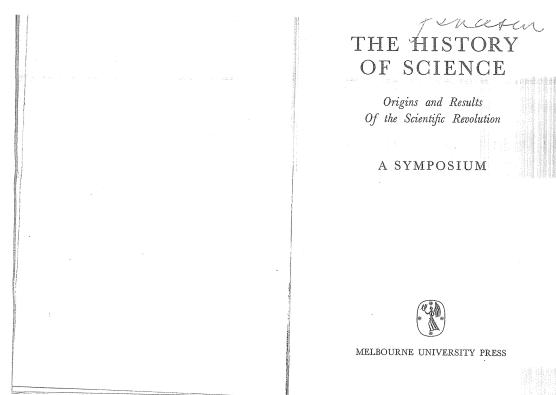


[Broad, C. D.] THE HISTORY OF SCIENCE

Wednesday, May 6, 2020 9:13 AM
Broad, The history of


[LECTURE] TITLE

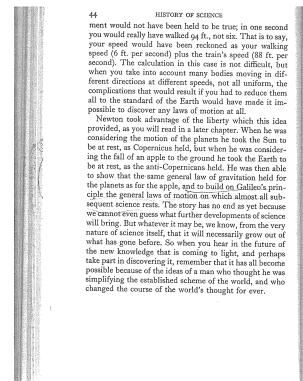
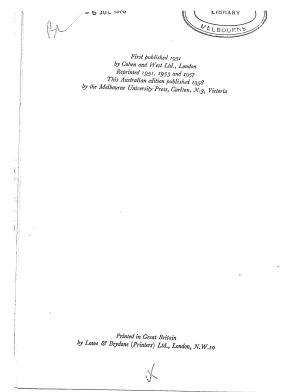
CUE COLUMN	NOTE TAKING COLUMN
P46 His one fundamental interest was to discover and propagate a general method by which men might gain scientific knowledge of the laws of nature and structure of matter, and might thus acquire ever-increasing power over them and more. He saw that, in order to collect the data from which the laws of nature could be deduced by his methods, a huge organisation of research would be needed.	Key Ideas/Important facts/Repeated statements/Information → creating the New Atlantic's optimistic view of the future of science?>

SUMMARY

Term	Definition

REVIEW QUESTIONS

Link to Anki:	
Question	Answer in white


I V
BACON AND THE EXPERIMENTAL METHOD
by C. D. Broad, Litt.D., F.B.A.
Especially Professor of Moral Philosophy at the University of Cambridge

I WILL begin by giving you very brief sketches of Bacon's life, so that you may have some idea of the kind of man he was and the society in which he moved. He was born at York House, Strand, London, in January 1561, i.e. about two years after the birth of Galileo. He studied at Cambridge as an undergraduate of Trinity College at the extremely early age of thirteen, and he left two years later. He then became a lawyer, and was called to the Bar, which became his profession. The Queen employed him much in legal and political business, but she seems not to have regarded him as a particularly brilliant lawyer. He became her agent office under her reign. After the accession of James I in 1603 Bacon's services were rewarded, for the King greatly admired him. He became Lord Keeper of the Seal, and in 1609 Viscount St. Albans. He was now a very wealthy man, but a tragedy was approaching. He had always been a gambler, and was extremely extravagant in his money-life, and he had followed the example of his father in his day in taking presents from suitors, though he always

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ment would not have been held to be true; in one second you would really have walked 94 ft., not six. That is to say, your speed would have been reckoned as your walking speed of 6 ft. per second multiplied by 15.6 times (94 ft. per second). The calculation in this case is not difficult, but when you take into account many bodies moving in different directions, and the fact that they all attract each other, the complications that would result if you had to reduce them all to the standard of the Earth would have made it impossible to calculate.

Newton took advantage of the liberty which this idea provided, as he will be read in a later chapter. When he was considering the law of gravitation, he had to assume that the Sun was at rest, as Copernicus had, but when he was considering the fall of an apple to the ground he took the Earth to be at rest, as Galileo had done. This was a very simple way to show that the same general law of gravitation held for the planets as for the stars, and to build on Galileo's subsequent science results. This has not as far as we know ever been even gauged what further developments of science will be possible, or what is necessary, from the very nature of science itself, that it will necessarily be capable of what the gene before. So when you hear in the future of the new science that has been discovered, and perhaps take part in discovering it, remember that it has become possible because of the ideas of a man who thought he was simplifying the established scheme of the world, and who changed the course of the world's thought for ever.

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That Bacon was an able, and up to a point successful, lawyer and politician, his heart was not in that work. His real interest was in science, and he believed that there was a general method by which might gain scientific knowledge of the ultimate laws and structure of matter, and thereby gain power over nature. He saw that, in order to collect the data from which the laws of nature were to be extracted by his method, 2,000 men, and 2,000 women, and 2,000 children, and 2,000 members of men, and women, at various levels, would have to be employed, and enormous buildings and apparatus would be required for this work. He had no real hope of getting adequate supplies of money and sufficient authority and prestige to start and continue such a scheme was for him to go to the King, and to represent himself and for him to persuade the King and powerful noblemen and their families to back it. In order to do this he must be ready to turn a blind eye to the fact that he will fail to humour their whims, and to play upon their weaknesses by flattery. Bacon was nothing if not thorough, and he analysed and practised with his usual acuteness and assiduity the arts of worldly success. I believe that, like many other

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question the Aristotelian theory that earthly bodies are composed of the four elements, earth, air, fire and water, and that heavenly bodies are fundamentally different, being composed of a superior fifth element, called the quintessence.

Corresponding to this lack of scientific knowledge was a lack of power over nature. The only available devices for obtaining power over nature were windmills, watermills, and windmills. All land transport was done by horse, and all water transport by rowing or sailing. Men were controlled by the theory of local and seasonal droughts and plagues, and were ruled by the theory of the stars, whose causes they did not understand and which they had no rational means of controlling. Bacon was impressed by this state of affairs, and even convinced himself that he could not be expected to foresee, what we have learned since, that men can bring even greater evils upon themselves by

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merely a few simple inventions. He started by seeking wealth and power wholly, or at any rate mainly, as a means to a high impersonal end, but gradually slipped into pursuing them for their own sake. I suspect also that, as often happens with people who are very successful, the means he used and despised were not quite so stupid as he imagined, and that he was seen through and distrusted mainly for them.

If we are to appreciate Bacon's originality, largeness and breadth of vision, and to be fair to his limitations and failures, we must bear in mind the state of the science of his own day and not against that of ours. The fundamental science of dynamics, for instance, did not exist in Bacon's time, nor did the theory of gravitation by Galileo (1564-1642), who also invented the telescope and noted with it the spots on the sun and the irregularities on the surface of the moon. He did not know that the earth is the fixed centre of the universe, and that the sun and the planets revolved about it, the latter in concentric circles. He did not know that the first three fundamental laws of planetary motion were made in Bacon's life-time by Kepler (1571-1630). It was not until long after Bacon's death that the first three laws of dynamics, and a principle of scientific theory on the grand scale and in the modern sense, by explaining these laws and correlating them with the theory of gravitation, were put forward. The theory of universal gravitation, Bacon's older contemporary Gilbert (1540-1604) had discussed some very interesting facts about magnetism, but the connection of electricity was unknown, and its connection with magnetism was unexpected. Chemistry, as a science and not a mere set of recipes, did not come into existence for another hundred and fifty years. Learned men commonly accepted without

corroboration the astronomical theories of Ptolemy, Aristotle, and others, and as far as I could find in his works he did not seem to have any real desire to discover the affections

abusing the power which science gives them than they suffered when they were powerless in face of it.

Now Bacon was completely convinced that the ignorance of nature and the consequent lack of power over nature, which had been the curse of humanity from the very first, were by no means inevitable. They sprang, not from any fundamental imperfection in the human mind, nor from any inherent weakness in the methods of science; but simply and solely from the use of a wrong method. He felt sure that he knew the right method, and that, if only this could be adopted, all difficulties would be removed at once, there was no limit to the possible growth of human knowledge and human power over nature. Looking back after the events of his life, he might well have been tempted to think that it was obvious. But it was not in the least obvious at the time; it was, on the contrary, a most

vading law and the minute structure of matter; and they were too jealous of each other, keeping their results secret rather than pooling them. Bacon valued science both as an end in itself and for the immense power over nature which it could give to humanity. He was grieved at the failure of contemporary physics to have any useful practical applications was a sign that it was on the wrong track. But he was equally grieved at the way in which scientists tended to work shortsightedly at the solution of this or that particular problem. Let them concentrate, he thought, on discovering by suitable methods what the fundamental principles are, the fundamental laws and structure of nature. Then, and only then, could they make innumerable practical applications without difficulty. This is the lesson which every student of science should learn, and especially the student who reflects on how our modern applications of electro-magnetism, of chemistry, and of medicine depend

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