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PROLOGUE

*The Origins of Modern Science* by A. N. Whitehead (iii)

A. During the past three centuries, the cosmology derived from science has been asserting itself at the expense of older points of view with their origins elsewhere. The growth of science has practically re-coloured our mentality so that modes of thought which in former times were exceptional are now broadly spread through the educated world. The new mentality is more important than the new science and the new technology. It has altered the metaphysical presuppositions and the imaginative contents of our minds, so that the old stimuli provoke a new response.

B. Perhaps my metaphor of a new colour is too strong. What I mean is just that slightest change of tone which yet makes all the difference. This is exactly illustrated by a quotation from* William James. When he was finishing his great treatise on the Principles of Psychology, he wrote to his brother Henry, "I have to forge every sentence in the teeth of irreducible and stubborn facts."

C. Modern science was born in Europe, but its home is the whole world. In the last two centuries there has been a long and confused impact of Western modes of thought upon the civilisation of Asia. The wise men of the East have been puzzling, and are puzzling, as to what may be the regulative secret of life which can be passed from West to East without the wanton destruction of their own inheritance which they so rightly prize. More and more it is becoming evident that what the West can most readily give to the East is its

science and its scientific outlook. This is transferable from country to country, and from race to race, wherever there is a rational society.

D. Greece was the mother of Europe; and it is to Greece that we must look in order to find the origin of our modern ideas. We all know that on the eastern shores of the Mediterranean there was a very flourishing school of philosophers, deeply interested in theories concerning nature. Their ideas have been transmitted to us, enriched by the genius of Plato and Aristotle. But, with the exception of Aristotle, and it is a large exception, this school of thought had not attained to the complete scientific mentality. In some ways, it was better. The Greek genius was philosophical, lucid and logical. The men of this group were primarily asking philosophical questions. What is the substrate of nature? Is it fire, or earth, or water, or some combination of any two, or of all three? Or is it a mere flux, not reducible to some static material? Mathematics interested them mightily. They invented its generality, analysed its premises, and made notable discoveries of theorems by a rigid adherence to deductive reasoning. Their minds were infected with an eager generality. They demanded clear, bold ideas, and strict reasoning from them. All this was excellent; it was genius; it was ideal preparatory work. But it was not science as we understand it. The patience of minute observation was not nearly so prominent. Their genius was not so apt for the state of imaginative muddled suspense which precedes successful inductive generalisation.

E. Of course there were exceptions, and at the very top: for example, Aristotle and Archimedes. Yet every philosophy is tinged with the colouring of some secret imaginative background. The Greek view of nature, at least that cosmology transmitted from them to later ages, was essentially dramatic. It thus conceived nature as articulated in the way of a work of dramatic art, for the exemplification of general ideas converging to an end. Nature was differentiated so as to
provide its proper end for each thing. I do not say this is a view to which Aristotle would have subscribed without severe reservations, in fact without the sort of reservations which we ourselves would make. But it was the view which subsequent Greek thought extracted from Aristotle and passed on to the Middle Ages. The effect of such an imaginative setting for nature was to damp down the historical spirit. As it was the end which seemed illuminating, why bother about the beginning?

F. Whatever the reason, in the year 1500 Europe knew less about science than Archimedes who died in the year 212 B.C. Nevertheless, medievalism made an important contribution to the formation of the scientific movement. The Middle Ages formed one long training of the intellect of Western Europe in the sense of order. The habit of definite exact thought was implanted by the long dominance of scholastic logic and scholastic divinity. The habit remained after the philosophy had been repudiated, the priceless habit of looking for an exact point and of sticking to it when found. However, the greatest contribution was the belief that every detailed occurrence can be correlated with its antecedents in a perfectly definite manner, exemplifying general principles. Without this belief, the incredible labours of scientists would be without hope. It is this instinctive conviction, vividly poised before the imagination, which is the motive power of research—the conviction that there is a secret, a secret which can be unveiled.

G. Around the year 1500, Greek manuscripts disclosed what the ancients had discovered. Invention stimulated thought, and the sixteenth century saw the rise of modern science. Nothing was settled, though much was opened—new worlds and new ideas. In science, Copernicus and Vesalius may be chosen as representative figures: they typify the new cosmology and the scientific emphasis on direct observation. In the same century, Galileo, reviving the historical spirit, kept enquiring how things happen, whereas his adversaries had a complete theory as to why things happen. It is a great mistake to conceive this historical revolt as an appeal to reason. On the contrary, it was a return to the contemplation of brute fact; and it was based on the recoil from the inflexible rationality of medieval thought.

H. All this prepared the way for the great scientific advance of the seventeenth century. By the end of the century, physics had been founded on a satisfactory basis of measurement. (Logical doctrines had said to the physicist "classify" when they should have said "measure"). The final and adequate exposition was given by Newton. The Newtonian conception has been brilliantly successful throughout the whole modern period. Its first triumph was the law of gravitation. Its cumulative triumph has been the development of dynamic astronomy, of engineering, and of physics.

(from Science and the Modern World,
Cambridge University Press, 1953: first published in 1926)

Note
A. N. Whitehead (1861-1947)—mathematician and philosopher, was a Fellow of Trinity College, Cambridge, then Professor of Applied Mathematics at the Imperial College of Science, London, and finally Professor of Philosophy at Harvard from 1924 till his death.

EXERCISES

1. STAGE TWO) Answer the questions as briefly as possible:
Where did our modern scientific ideas first come from?
What were the Greek philosophers chiefly interested in?
What did the Greek genius produce? What did it lack from a modern scientific point of view? Did this apply to all the Greek philosophers? How does Whitehead describe the Greek view of nature? What advance in scientific knowledge was made during the Middle Ages?
Did medieval scholars make any contribution towards the formation of the scientific movement? When did
the advance in science begin again? Name two causes of its revival. What method did Copernicus and Vesalius consider important? Where did Galileo place his emphasis? And Newton?

2. (Stage Three) Answer in complete sentences: What influence has the growth of science had on our way of thinking? Give an example, from the text, of the modern scientific mentality. What part did the dramatic view of nature play in the development of science? State three contributions of medieval scholarship to the formation of the scientific movement. What was Galileo's attitude to medieval thought? How did Newton's attitude to physics differ from that of the Middle Ages?

3. (Stage Four) A person who specialises in science is called a scientist. He tends to look at every problem from a scientific point of view. Repeat these two sentences, replacing science first by technology, then by psychology, philosophy, mathematics, history, astronomy, metaphysics, physics, engineering, and making the other changes necessary.


5. Verb  Noun  Adjective
prepare  preparation  preparatory

Put the following words in the appropriate column, and then complete the table: confuse, convince, destructive, different, emphasis, imagine, infect, origin, reduce, theory. Pronounce each word correctly, paying attention to vowel sounds and syllable stress.

6. (Stage Five) Write 10 to 20 lines on the following, after oral preparation:
a. The "scientific outlook" (referred to in paragraph C).
b. The ancient Greek and the medieval attitude towards the natural world.