



Summary

Robert Boyle's philosophy of nature and natural science. The philosophical genesis of laboratory research

Many philosophers of science and natural scientists engaged in philosophy share the opinion that the philosophical convictions adopted by researchers influenced the emergence and development of science. In the literature it is established that philosophical convictions impacted on the form of conceptual apparatuses in particular natural science disciplines, such as mass in Newton's physics, the elements in Robert Boyle's or orbital or bonds in modern-day chemistry. Outside the objective methodological context of natural science which accompanied the pursuit of science, philosophical convictions marked out the boundaries of what was deemed scientific inquiry and valuable research findings. From this point of view, philosophical convictions in science defined what philosophers called paradigms (Thomas Kuhn), thought style (Ludwik Fleck) or epistemological systems of reference (Kazimierz Jodkowski).

With regard to the above, the following questions can be posed: Should the analysis of the influence of philosophical beliefs on science be restricted to the context of scientific discoveries, or can they also be sought in the process of justifying scientific statements?; Did philosophical convictions adopted at a particular stage of scientific progress accelerate (or slow down) the development of scientific knowledge?; Did researchers accept philosophical convictions consciously or were they only guided by considerations of a cognitive nature?; Were scientists' philosophical convictions rooted in the dominant world-view of the time?; In which fields of scientific inquiry did philosophical convictions act most strongly?; How did philosophical assumptions impact on how theoretical concepts were formed and on the ways research is conducted?

The philosophical convictions of the 17th-century luminaries influenced the shape of the modern paradigms of scientific cognition. Among the most significant are: rationalism and empiricism, naturalism, a focus on realizing cognitive values, and also enhancing the practical merits of scientific cognition. Along with progress in scientific cognition, systems of philosophical convictions assumed by scientists underwent transformation. However, the central philosophical theses of the 17th century model of conducting scientific activity continue to constitute the philosophical resources for modern-day natural science.

The discussions in this book analyse the process of forming the philosophical base of laboratory research practice, whose beginnings are associated with the accomplishments of Robert Boyle (1627–1691). What interests me is the way in which the philosophical convictions and disputes of Boyle's times impacted on the subsequent development of laboratory science. I shall argue that Boyle's philosophical outlook not only laid the non-academic foundations for laboratory-style research, but are also present to a significant extent in the philosophical base of laboratory science nowadays.

In this book, I present the arguments supporting the thesis that Robert Boyle's philosophy of nature and natural science played an important role in shaping modern-day philosophical and methodological base of laboratory research. Such research has undergone many changes since the emergence of Boyle's laboratory style. Boyle's laboratory and modern-day laboratories are in no way comparable, although laboratory science since the 17th century has been based on a fixed and characteristic set of assumptions. These are philosophical assumptions: about the primacy of empirical experimentation in the natural science laboratory, and also the development of laboratory science research practices was closely related to improving research equipment and standardizing research.

In Chapter One, I present Robert Boyle's philosophical views. I base my analysis on those studies in the philosophy of science which are recognised as the most significant in the subject literature in interpreting this philosopher's output. Moreover, after analysing Boyle's writings, I consider some strands of his philosophical thought.

In Chapter Two, I present selected philosophical concepts from laboratory science. From the 20th century onwards laboratory science has developed very dynamically, and laboratory science now constitutes the core of natural science. This is the reason why I have presented a description of laboratory science and emphasised specific epistemological and methodological aspects of laboratory research practice in the natural sciences, in which experiments play the central role.

Despite the fact that laboratory science has developed so quickly since the 20th century, and that laboratory research constitutes the core of present-day natural science, the philosophy of science devotes relatively little space to considering this research method. This is connected with the fact that the conviction that the essence of scientific cognition is through theorizing rather than experimental practice is well-grounded in the philosophy of science tradition. In order to give research methods the space they deserve, I refer to Ian Hacking's taxonomy of the components of laboratory science, Hasok Chang's idea of the 'philosophical grammar of scientific practice', Danuta Sobczyńska's discussions on the nature of experimental research and issues raised in philosophical reflections on chemistry, and some philosophical intuitions formulated by sociologists of science.

In Chapter Three, I present my own proposition for systematizing philosophical convictions that appear in science. The starting point is Kazimierz Jodkowski's concept of an epistemological system of reference. In accordance with his theory, the epistemological system of reference based on naturalism is, in the broadest sense, a non-academic basis for undertaking natural science activities. My description of the internal construction of this system refers to the conceptual framework put forward by two representatives of the Lvov-Warsaw School: Henryk Mehlberg and Zygmunt Zawirski, as well as Robin G. Collingwood.

The conclusions drawn in Chapter Three are used to reconstruct the hypotheses of Boyle's epistemology. On this basis I go on to argue in Chapter Four that Boyle's epistemol-

ogy should be defined as experimental. I use this term to denote a philosophical standpoint in accordance with which the principal tool of scientific cognition is the experimental method. I show how Boyle developed an original laboratory style of conducting research and list Boyle's philosophical deductions, which determined how the epistemological stance was formed in modern science, and which in turn enabled Baconian progress in science and laboratory in modern science.

In the conclusion, I sum up the analysis and formulate conclusions. Boyle's significant achievements in philosophy solved the problem of the objectivity of knowledge generated in practice. He formulated and justified methodological directives, adherence to which made it possible to develop protoscientific experiment-based activities in academic laboratory research, whose procedures constitute the modern-day foundations of laboratory science.

Translated by Rob Pagett