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Critical Appraisal of Physical Science as a Human Enterprise

Dynamics of Scientific Progress

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Mansoor Niaz
Epistemology of Science Group
Department of Chemistry
Universidad de Oriente
Cumaná, Estado Sucre
Venezuela

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For Magda and Sabuhi
For their love, patience, and understanding

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Contents

Chapter 1
Introduction

It is generally believed that doing science means accumulating empirical data with no or little reference to the interpretation of the data based on the scientist's theoretical framework or presuppositions. Holton (1969a) has deplored the widely accepted myth (experimenticism) according to which progress in science is presented as the inexorable result of the pursuit of logically sound conclusions from unambiguous experimental data. Surprisingly, some of the leading scientists themselves (Millikan is a good example) have contributed to perpetuate the myth with respect to modern science being essentially empirical, that is carefully tested experimental facts (free of *a priori* conceptions), leading to inductive generalizations.

Based on the existing knowledge in a field of research a scientist formulates the guiding assumptions (Laudan et al., 1988), presuppositions (Holton, 1978, 1998) and "hard core" (Lakatos, 1970) of the research program that constitutes the imperative of presuppositions, which is not abandoned in the face of anomalous data. Laudan and his group consider the following paraphrase of Kant by Lakatos as an important guideline: philosophy of science without history of science is empty. Starting in the 1960s, this "historical school" has attempted to redraw and replace the positivist or logical empiricist image of science that dominated for the first half of the twentieth century. Among other aspects, one that looms large in these studies is that of "guiding assumptions" and has considerable implications for the main thesis of this monograph (Chapter 2).

Many major steps in science, probably all dramatic changes, and most of the fundamental achievements of what we now take as the advancement or progress of scientific knowledge have been controversial and have involved some dispute or another. Scientific controversies are found throughout the history of science. While nobody would deny that science in the making has had many controversies, most science textbooks and curricula consider it as the uncontroversial rational human endeavor (Machamer et al., 2000).

The objective of this monograph is to reconstruct historical episodes and experiments that have been important in scientific progress, to explore the role played by controversies and rivalries among scientists. Although progress in science has been replete with controversies, scientists themselves either ignore or simply downplay their role. Such presentations lack the appreciation of the dynamics of

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