bottom up rather than the top down—Middleton is able to give insight into such matters as the morale of the Division at various stages.

The National Research Council is Canada's leading scientific institution, and from these two studies of it Americans can learn much about the development of national science in their northern neighbor. The story is an interesting contrast to that of this country as presented, for example, in Hunter Dupree's *Science in the Federal Government* (1957) or Daniel Kevles's recent book, *The Physicists* (1978).

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A View of the Soviet Scene

Manipulated Science. The Crisis of Science and Scientists in the Soviet Union Today. MARK POPOVSKY. Translated from the Russian by Paul S. Falla. Doubleday, Garden City, N.Y., 1979. xviii, 244 pp. + plates. $10.95.

Before coming to the West from the U.S.S.R. in 1977 the author of this book was a prominent scientific journalist and biographer with a wealth of acquaintances within the Soviet scientific community. He has drawn deeply upon his personal experiences in order to write a polemical account of how the Soviet scientific system works or, to be more accurate, fails to work. Unlike Western accounts of the economics and administration of Soviet science, which are dependent upon open sources, impressions from study visits to the U.S.S.R., and selected interviews with Soviet research administrators, Popovsky's seeks to convey by wealth of anecdote and rumor the "real" flavor of the Soviet scientists' working life. Popovsky is remarkably uninhibited about naming the major culprits in high official positions in the Soviet scientific establishment, so that by the end of the book the reader is provided with a kind of rogues' gallery complete with identikit photographs. The book is written in a lively and persuasive style and is clearly motivated by a passionate desire to expose "the truth" that lies behind appearances and misleading official representations. Thus the critical Western reader, although he or she will read Popovsky's book with interest, is faced with the problem of deciding how much of it is typical or true, what relative weights should be attached to anecdotal compared with published sources (often critical but invariably restrained), and whether such a damning indictment of the political leaders' intentions is plausible in view of their expressed desire for rapid technical progress. In other words, is the case overstated?

The picture of Soviet scientists drawn by Popovsky is the exact opposite of Merton's classic view of the scientific community as a self-regulating group of independent scholars whose internalized norms of open-mindedness and peer evaluation are central to the promotion of scientific advance. According to Popovsky the political offensive against the technical intelligentsia began not in the late 1920's, as most Western historians would have it, but abruptly after the Bolshevik seizure of power in 1917. The political authorities made war on the old scientific establishment by a policy of deliberate starvation and intimidation and subsequently replaced them by politically loyal but often poorly trained cadres. All this served their primary objective of *political control* over opposition groups, real or potential. The unfortunate combination of obsessive control with long-standing Russian traditions of hierarchy and rank served to displace collegial relationships in science. A new generation of institute directors grew up eager to do the bidding of their political masters, unscrupulous in the pursuit of their own careers, and ruthless in their control over subordinate staff. Even those of genuine ability and conscience were able and are able, in various convoluted ways, to rationalize the compromises of their scholarly integrity that the Soviet system imposes; the rank-and-file scientific workers, on the other hand, derive what enjoyment they can from their scientific work but otherwise react to their administrative superiors with tact, private cynicism, and calculated apathy.

There are several factual errors in Popovsky's account, but much more important than these are the glaring omissions of counterevidence that would have necessitated some modification of the central message. For example, it is difficult to take seriously a history of Soviet science and technology that gives the government *no* credit for the industrialization of a backward country, the promotion of widespread literacy, the improvement in health and living standards of ordinary people, or the funding of science on such a generous scale. If this sounds like the insistence of the censor that the positive side should outweigh the negative it is certainly not intended as such. The technological and economic achievements of the Soviet regime can still be reconciled with the predicament of the individual scientist, but the interpretation needs to be based on a much more subtle understanding of the trade-off between economic and political goals. Moreover, the assertions that the authorities are willing to sacrifice efficiency in order to achieve maximum control (p. 49) and are hostile to good ideas because they highlight their own mediocrity (p. 142) do not allow for the frantic and evidently sincere concern the leadership has shown about the current slowdown in the rate of economic growth in the U.S.S.R. and about the wide technology gap that has opened up with the West in many key sectors.

Notwithstanding some doubts about its objectivity, this book maintains the interest of the reader throughout and has many new things to say. The chapters on research institutes in the defense sector and on the deterioration of the working atmosphere in the new science cities find no equivalent in other works on the subject, and Popovsky's classification of the different psychologies of research workers in the face of political interference is illuminating. Zhores Medvedev's recent book *Soviet Science*, which covers much the same ground as Popovsky's, is a cooler and more thoughtful book than Popovsky's but less rich in anecdotal material. In this sense, the two books are complementary. The restrained systemic analysis of the former tempers the fiery journalism of the latter.

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Galileo as Scientist

Galileo at Work. His Scientific Biography. STILLMAN DRAKE. University of Chicago Press, Chicago, 1978. xxiv, 536 pp., illus. $25.

Scientists have found Galileo Galilei most congenial, in the sense that they have been inclined to find their own "roots" in his work. The practice goes back at least to Isaac Newton, who in his *Mathematical Principles of Natural Philosophy* credited Galileo with knowledge or discovery of several concepts used in his own system of the world, specifically the law of inertia, the law of force, the principle of superposition of motion, the times-squared law of fall, and the parabolic path of projectiles. The list also includes Albert Einstein, who wrote a foreword to Stillman Drake's English translation of Galileo's *Dialogue Concerning the Two Chief World Systems* (1953) in which he summarized the main