

Introduction

Michael Heyd

Department of History, The Hebrew University, Jerusalem

For the past two generations, much scholarly attention in the history of science has focused on the issue of science and religion. In reaction to previous positivist historiography, which saw the relationship between science and religion essentially as that of warfare and which viewed modern science as a primary factor in the secularization of European culture in the modern period, many historians since the Second World War (though by no means all) tended to problematize this relationship. Quite a few have chosen to emphasize the *positive* contributions of religious traditions (and those of clerics) to the development of modern science. Consequently, the role of science in “secularizing” western culture has to some extent been set aside, with the notable exception, perhaps, of debates regarding Darwin’s religious views and the secularist impact of Darwinism (see, for example, Kohn 1989). In recent years, however, there is renewed interest in the relationship between science and secularization, and not only with respect to the nineteenth century (Brooke 1991; Heyd 1982, 1988; Vermij 1991; Webster 1995, and others). Nevertheless, historians of science have usually shied away from a systematic discussion of the issue of “secularization,” possibly because of its positivist connotations and because of the real difficulties in defining the term.

The question of the relationship between science and secularization in the modern world is however still worth posing and investigating. The increasing challenges to modern “rationalist” culture, whether of post-modernist provenance or from radical religious trends at the beginning of the twenty-first century, may also set a new intellectual and ideological context within which to pursue this question. The idea, of course, is not to go back to the simplistic notions of the “warfare between science and theology in Christendom,” but rather to re-examine this problem precisely on the basis of the insights and knowledge gained in the past generation concerning the complex relationships between science and religion.

Given that historiography, is there any meaning still in talking about “secularization” in general, and the relationship between science and secularization in particular? Much depends, needless to say, on the way one defines these terms, “science” and “secularization.” The debate among sociologists is still raging about the meaning of the term “secularization” and the extent to which the so-called “secularization model” – which implies the decline of religion in the modern period, or at least, the gradual loss of the public significance of organized religion – is still valid. One should talk more precisely of secularization *models* in the plural, since there

are several paradigms that assume a secularization process, models which need to be distinguished in the way they understand the essence of that process (see for example, Hadden 1987). After years of skepticism concerning these paradigms, there are increasing voices in recent years claiming that reports of the demise of the concept of “secularization” may have been premature. (For the proponents of secularization paradigms, see Luckmann 1967; Wilson 1966, 1982; Martin 1978; Fenn 1978. For skepticism or even rejection of such models see Martin 1969; Stark and Bainbridge 1985, 1987; Stark and Iannaccone 1994; Demerath 1995. For the general debate among sociologists see Bruce 1992. For attempts to re-assert the concept of “secularization,” even if in a modified form, see Lechner 1991; Tschannen 1991; Wallis and Bruce 1992; Yamane 1997).

Which senses of “secularization” are meaningful for the historian of science? This is the question posed by the present collection of articles based on a conference of the International Colloquium for the history and philosophy of science held in Tel-Aviv and Jerusalem in the spring of 1999. We have attempted not only to address this problem in a broad chronological perspective, from the early sixteenth century to the late twentieth, but also to avoid confining ourselves to Christian Europe, and examine also some cases of natural philosophical interests within Jewish communities in Europe. (Ultimately, an exhaustive discussion of the question would surely require the examination of science *outside* of Europe too, primarily science in Moslem societies, and its relationship with secularization.) As for “science,” we have focused here mostly on the natural sciences, in the broad historical sense of “natural philosophy,” but included, as shall be seen below, disciplines such as medicine and mathematics too.

A primary conclusion clearly emerges from the articles that follow: They indicate that the connotations of the term “secularization” themselves change in the course of the modern period. One classical meaning of the term that is especially appropriate for the early modern period is the Weberian concept of “the disenchantment of the world” (*Die Entzauberung der Welt*). Charles Webster in the opening article systematically applies this concept to the thought of Theophrastus Bombast von Hohenheim, known as Paracelsus. He shows that Paracelsus, a radical Protestant, contributed to the “disenchantment” of the world first of all in his critique of the magical claims of the Catholic Church (the healing powers of Saints, the therapeutic powers of shrines, etc.). Such a critique, from the medical perspective, meant that the sphere of religion, or at least, that of *institutional* religion, was severely restricted, in favor of alternative medical, natural, though also magical means. Moreover, in extending the realm of natural magic in medicine, Paracelsus contributed to the secularization, or the disenchantment, of magic itself. Webster emphasizes that one should beware of seeing Paracelsus in too modern terms as a harbinger of the new experimental science or the new Cartesian worldview. His medicine and science were deeply embedded in magical terms. Nevertheless, the type of magic Paracelsus developed was naturalist, rather than supernatural, susceptible not only to human control, but also accessible to the public. Hence, Webster argues, the Weberian

concept of secularization can be applied to the discipline of magic, which itself may be seen as a scientific (or natural philosophical) enterprise at that period.

“Secularization” may also be taken, however, in the sense of *differentiation*, as differentiating certain realms of human behavior and cultural activity from the ultimate concerns of religion and salvation. The secularization of *science*, in our case, means the neutralization of science from such religious concerns and from the theological controversies so paramount in the sixteenth and seventeenth centuries. An extreme case of such controversies was the Christian-Jewish theological debate. Could science, or more properly speaking – natural philosophy, astrology, geography and medicine – be dissociated from these controversies? This is the question Noah Efron deals with in his article, focusing mostly on the late sixteenth century. He deals with this problem not only from the point of view of the *practice* of natural philosophy, but mostly as far as its *object* is concerned. Was human nature (and hence, medicine) different in the case of Jews than in the case of Christians? Was astrology different in its influences on Jews from the astrological influences over the fate of Christians? Among Jewish intellectuals of the late sixteenth and early seventeenth century there was an increased realization that science and medicine were indeed “neutral,” that they applied equally to Jews and Christians alike. Yet the implications of this realization could be contradictory. For traditional rabbis like Rabbi Judah Loew (the *Maharal*) of Prague, this meant that natural philosophy and medicine were universal yet unimportant, divested, as they had been, from any religious significance. Jewish intellectuals interested in science like David Gans, on the other hand, insisted on the importance of such pursuits, even if, and perhaps, *because*, they could be common to Jews and Christians alike.

Similar tensions can also be detected among Christians in the seventeenth century. Whereas the historiography of the relationship between science and religion in the seventeenth century, and the potential “secularizing” implications of the former, usually concentrates on the *content* of the new natural philosophy or the nature of religious attitudes, Mordechai Feingold in his article examines the problem on the level of *vocation*. He sees (more precisely, he argues that contemporaries had seen) the secularizing potential of scientific pursuits in terms of the *time* and energy allocated to such pursuits. The *practitioners* of natural philosophy, mathematics, and other secular disciplines in England were often divines. Or, to be more exact, in an age in which science was hardly “professionalized,” young intellectuals interested in science had sooner or later to assume an ecclesiastical career as a means of living and social advancement. Upon doing so, however, they often developed serious qualms about the justification of continuing their scientific pursuits. Feingold’s argument is that “norms governing the propriety of ministerial duties – shared by all English Protestants – informed their expectations vis-à-vis the direction of their energies and the medium for its channeling.” In this respect, they were not that different from Jewish intellectuals of the same period. If natural philosophy, mathematics (or any other secular pursuit for that matter) did not have a direct bearing upon theological

concerns – what I have called elsewhere “negative autonomy” (Heyd 1988) – or even only limited bearing, what justification was there to devote much time to it at all? These doubts, Feingold claims, bedeviled mathematicians, natural philosophers, and other intellectuals-turned-clerics, up to the early eighteenth century.

Nevertheless, and this is another point stressed in Feingold’s paper, such qualms may be seen as the background for precisely the new kind of “natural theology” that began to emerge from the mid-seventeenth century onwards, a natural theology which saw the new experimental philosophy making an *active* contribution to theology. While not directly *subservient* to theology, natural philosophy could be seen as providing some *support* to religion. Its autonomy was thus “positive” rather than negative. Nature was conceived as God’s second book, besides Scripture, and as such, a bridge (or, to use a term of mystical connotations, a ladder, Jacob’s ladder) toward the knowledge of God. (On the need for such a bridge in post-“Axial Age” civilizations, including Christianity, and on the sociological “carriers” of that bridge, see Eisenstadt 1982, 1988; Heyd 1988). The legitimacy accorded to science had itself to be ultimately grounded in religious sanctions, even if those sanctions became increasingly “natural.” According to Feingold, the claim that the new experimental science had such a role – glorifying God by investigating His works and exhibiting His wisdom – was at most a *rationalization* for the practice of science, not a *motivation* for doing it. Is the distinction that clear-cut, however?

The case of Robert Boyle, discussed by Michael Ben-Chaim, may be a case in point. Unlike the divines dealt with by Feingold, Boyle was a layman, having the means to pursue experimental work independently. Yet for him these pursuits were saturated with religious significance. Indeed, Ben-Chaim claims in his article that, far from involving “secularization,” Boyle’s experimental science was in fact a form of worship. He calls Boyle a “priestly philosopher” and sees not only the motivations, but also the very epistemological foundations of Boyle’s experimental philosophy in his religious and moral convictions. According to Ben-Chaim – referring to the most recent scholarship concerning Boyle, and at the same time, diverging from it on some important points – Boyle conceived a relationship between God and Man which can be called a type of “moral economy,” a relationship in which the divine goods provided to humanity can, and should be reciprocated by man in the study of the works of Creation. Such “moral economy” had its social dimension as well. Heir to the English humanist tradition, Boyle did not distinguish between the reform of society and Reformed religion. Moreover, Boyle’s experimental science may be taken as an example of what the late Amos Funkenstein called “secular theology” in the seventeenth century.

True, Ben-Chaim explicitly disclaims the label “theology” for Boyle’s religious sensibilities and stresses that experimental philosophy was a type of religious *practice* rather than speculative theology as far as Boyle was concerned. It should nevertheless be emphasized that we are dealing here with the claims of laymen, not clergymen, to develop and practice essentially new forms of divine worship and religious piety. Feingold’s point about the inherent limitations imposed on *clerics* in their scientific

pursuits does not therefore contradict the argument advanced by Ben-Chaim. In this respect, the new science may have contributed to what could be called “vocational secularization.” By the late seventeenth century, those responsible for divine piety and in charge of the formulation of a “bridge” linking man and the divine were not necessarily clerics, but could be scientists as well.

Once again, parallel tensions can be detected in the Jewish world a few generations later. Indeed, the juxtaposition of Feingold’s article with that by Shmuel Feiner draws our attention to fascinating analogies, not usually noticed by historians of science, focusing as they do exclusively on Christian society. Feiner deals (like Feingold) with the relationship between science and secularization in terms of its practitioners (or amateurs), and with the emergence of a new type of lay intellectuals. As in the case of Christian society, interest in the new natural philosophy first arose among members of the traditional elite, including the religious elite. Such interests generated tensions (both internal, within the minds and hearts of its practitioners, and external) that were much more acute, however, than in the Christian case. First of all, the lack of intellectual continuity in natural philosophy within Jewish Ashkenazi society meant that even the return to Medieval rationalist Jewish Philosophy seemed threatening to the traditional rabbinic elite. Secondly, by the eighteenth century, as in Christian society too, the engagement with experimental philosophy could lead (or at least seemed to lead) to deism and religious skepticism. Nevertheless, the early *maskilim*, the emerging new Jewish intellectual elite, did not see their scientific pursuits as threatening religious orthodoxy. Rather, they fought for a measure of autonomy of science. Secularization, in the early Jewish *Haskalah* (Enlightenment) – as in some Christian European circles in the seventeenth century – meant primarily the differentiation of cultural spheres, though the claim for autonomy could have a more “anti-clerical” (more precisely, anti-rabbinical) thrust in Jewish society than in parallel Christian society for the reasons mentioned above. Only by the end of the eighteenth and the early nineteenth century did this intellectual orientation, and the latent anti-clerical thrust it involved, develop into an anti-traditional ideology, with a fully-fledged new secular intelligentsia. This intelligentsia either became increasingly assimilated in the surrounding culture (especially in Western Europe) or developed an alternative secular Hebrew culture (first in Berlin, later in Eastern Europe).

The entrance of Jews into the scientific community of the nineteenth century was made possible by another type of secularization – the transition from science practiced within a broad (even if diluted and “naturalist”) religious framework to science practiced by professional scientists with no religious commitments, at least not public ones. Joan Richards’ article deals precisely with one highly interesting expression of this trend, the mathematics and logic of August De Morgan. Her article exemplifies several of the meanings of “secularization”: First, it deals with the secularization of the educational environment in which science developed – the University of London, which De Morgan joined after graduating from Cambridge. In contrast to Oxford and Cambridge, which had still kept strict religious limitations

on the admission of students, the University of London was essentially a secular institution, open to members of all religious persuasions, Christians and non-Christians alike. Moreover, its educational model was not a holistic one, as it had been in Oxford and Cambridge, where theology (even if natural theology as it developed in the eighteenth century) reigned supreme as the ultimate goal of all the disciplines. Mathematics and logic could have an independent status, irrespective of any religious considerations. In this respect, one witnesses in the second third of the nineteenth century in England a secularization of the organization of knowledge and the place of mathematics in it. As Professor Richards shows, this was precisely one bone of contention in the debate between De Morgan and Henry Longueville Mansel. For De Morgan, religion was relegated to the private sphere. (Such “privatization” of religion is indeed one of the classical definitions given to “secularization” by sociologists, see Luckmann 1967). Mathematics and logic were not just “autonomous” in the sense that they had been in the seventeenth and eighteenth centuries. They became a formative part of the public intellectual sphere that was completely secular. In fact, Richards shows that De Morgan’s whole enterprise in both mathematics and logic involved the secularization of Reason itself. Whereas William Whewell saw mathematics as a model of rationality that supported natural theology, and Mansel circumscribed Reason and logic to a very limited formal sphere, De Morgan wished to *expand* the realm of mathematics and logic (though not without recognizing some limitations of human reason and the value of traditional humility). He was therefore reluctant to give up the links between the formal realm and the material-empirical one, claiming that mathematics and logic dealt with both. Richards’ paper thus draws our attention to an issue historians rarely address: the need to analyze and deconstruct the concepts of “reason” and “rationality,” concepts which themselves can undergo a process of “secularization.”

In his unwillingness to give up the relevance of logic and mathematics to empirical reality, however, De Morgan was already on the defensive in his time. While a radical secularist, and perhaps *because* of that “positivist” stance, he was a traditionalist in his unwillingness to give up the connection between form and matter, mathematical or logical rationality and empirical reality. By the turn of the century, as Gabriel Motzkin shows, the traditional equivalence of truth and reality could no longer be maintained, precisely because of developments in mathematics. The disjuncture between the two had far-reaching implications, also for the issue of science and secularization. Indeed, not only the disjuncture of truth and reality, but also the disintegration of the subjective conscious rational self (the result of evolutionary biology on the one hand and the emergence of psychology and psychoanalysis on the other), posed serious questions concerning the Enlightenment assumptions about the “secularist” potential of science. Motzkin stresses that when one wishes to examine the cultural and religious implications of science at the turn of the century, distinctions should be made not only among the various scientific disciplines, as a unified scientific vision was rapidly disintegrating, but also between different religious contexts, primarily between Catholic and Protestant ones. Consequently, “secular-

ism” as an ideology was promoted not so much by practicing scientists as by professional intellectuals, journalists, physicians and lawyers. At the same time the crisis of science could lead to either new types of rationalism (such as logical positivism) or to desecularization and to new types of religiosity, whether Christian or neo-Pagan.

Motzkin’s essay reminds us of the need to distinguish between the secularization of science on the one hand, and the cultural implications and ideological uses (as well as misuses) of science by the surrounding society on the other (see also Brooke 1991). Moreover, twentieth-century experience, cultural and political, indicates that secularization does not necessarily imply rationality either. It is against this background that we should see the contemporary interest in, and debates about, the “secularization paradigm” on the one hand, and the historiographical controversies concerning the links between science and secularization on the other.

Is there, then, any one meaning of secularization which can be applied to science from Paracelsus up to the twentieth century crisis of modernity? On the basis of the present collection of articles one may wish to answer in the negative. We are way beyond the Whiggish or positivist view of history (and science) that assumed some gradual homogeneous process of secularization in which science plays a crucial role. At the same time, the following articles point to highly interesting and significant connections, connections between Christian and Jewish science, as well as links between the meanings of secularization in different periods. A certain dynamic may be detected in the present collection: a movement from the disenchantment of magic through the growing “naturalist” character of the religious basis of science, the relative autonomy gained by science, the secularization of the elite interested in science and later the professionalization of science as well as its complete dissociation from religious purposes, and finally, the severance of science from ultimate meaning and ultimate concerns altogether. We should be careful in accepting such broad dynamics as the indication of an ongoing “process.” Nevertheless, we may rely on the much-discussed relationship between history and memory in recent years and say that the *memory* of science in our culture is that of a principal factor of secularization. Such memory has itself to be taken seriously by the historian who wishes to analyze, but also to question, the connections between science and secularization.

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