INTRODUCTION

This essay has two parts.

Part II reproduces in substance a lecture, "Albert Einstein, how he was and what he did," given on the Rice University campus on March 14, 1979, in commemoration of Einstein's hundredth birthday. It is an analysis of Einstein's achievements in physics, terrestrial and cosmological; of his mode of originality; of his impact both on physics and on philosophy; and, importantly, of his resistance to certain innovations in physics that came after his. The lecture harmonizes certain features of Einstein's intellectual constitution, scientific and general, by viewing him as a personage with intellectual roots in and flowering fully in the ambience of the nineteenth century. It is true that Einstein's high creativity falls into the period 1900-1920. But—as was stipulated in the lecture, and will be observed throughout the essay—our nineteenth century is deemed not to end in 1900 but to extend till after World War I, so that our twentieth century (proper) begins only then, that is, not much before 1920. This is not at all an *ad hoc* postulate. This manner of separating the two centuries has been burrowing in my thinking for a long time and has surfaced, insinuatingly and demandingly, in the present context. Still, Einstein did enjoy enormous applause and a raptly listening audience in the "true" twentieth century, so that he was indeed situated "between centuries," as is signified in the title of the essay.

Part I creates a setting for Part II, but has an identity of its own. It offers divers observations on developments in the nineteenth and twentieth centuries that widen out Einstein's topics in physics into themes in intellectuality at large. The physical topic of general relativity subsumes itself under a comprehensive theme of "Space and (geometric) Structure"; and the subject matter of quantum theory, "old" and "new," that deeply influenced Einstein's career from first to last, is part of a universal theme of "Comparisons and Contrasts between the Continuous and the Discontinuous (or the Discrete)." The theme of Space and Structure has been, in my view, highly creative since the end of the Middle Ages, and the theme of Discontinuity versus Continuity clearly goes back to classical

antiquity. But in the present context we will concentrate on developments since 1800, and my presentations will of themselves justify this restriction. Also, I will round out Part I with some observations that may not visibly bear directly on Part II.

Our leading theme in Part I will be Continuity and Discontinuity, because it gives rise to a significant distinction between the two centuries, the nineteenth and twentieth. Nineteenth-century physics created a major theory on this theme, the statistical theory of matter. But in this theory as everywhere else, the century gave considerable presumptive preference to Continuity over Discontinuity. As will be explained in Part II, however, in the twentieth century, after Einstein had peaked, physics took a sharp turn towards giving recognition to discontinuity, much to Einstein's abiding but futile chagrin. This turn towards discontinuity was a momentous development, gloriously forward-directed, and the twentieth century can take pride in this rare mark of superiority of strength over the nineteenth. It is an aim of Part I to extend this complex of presumptions and insights from the confines of physics into open areas of intellection, showing how the Continuous and the Discontinuous are becoming evermore equipoised. Immanuel Velikovsky's *Worlds in Collision* (1950) endeavored to identify large-scale discontinuities in very recent behavior of our planetary system. Academic professionals were scandalized by this work, but it subsumes under our general theme nonetheless.

We will not start Part I with a blunt assault on my primary theme. Rather I will ease into it after presenting striking instances of nineteenth century originality. That the nineteenth century had an originality *sui generis* readily suggests itself by the following: Carl Becker in a small but unforgettable book, *The Heavenly City of Eighteenth Century Philosophers* (1932), could propose that, on the whole, the intellectual attitudes of that century were medieval rather than modern, Voltaire or no Voltaire.[1] But no such pull-back of the nineteenth century to a previous one is on record, or is likely to be proposed in earnest. At any rate we will find that the nineteenth century was the first to overcome certain impedimenta, technological and scientific, that had persisted since Antiquity, right through the Middle Ages, the Renaissance, the Scientific Revolution, and the Age of Enlightenment.

For mathematics I have anticipated this in a previous essay, "The Emergence of Analysis in the Renaissance and After."[2] We there found that, in the age of the Renaissance, mathematics came under the rejuvenating dominance of suddenly emergent Analysis; that "the three centuries 1500-1800 in the rise of modern mathematics 'genetically' correspond to the three centuries 500-200 B.C. in the rise of Greek mathematics, . . . but that this genetic correspondence breaks down after the terminal dates, totally and irretrievably."[3] After 200 B.C., Greek mathematics began to slide down, slowly but inexorably, towards an extinction in its own phase; whereas in modern mathematics after 1800 phenomena of "firstness" came to the fore analogous to those in fields of

science and technology. In the present context I will not give to mathematics a precedence of description, but let it find its turn in due course.

Among the differences between the nineteenth and twentieth centuries there is a "sociological" one, which can be presented immediately now, however elusive and contestable it be. The difference is that the twentieth century has not produced anybody of the truly universal standing and recognition of an Einstein, Freud, Tolstoy, Darwin, or even Karl Marx. To be sure, in the twentieth century there are counterparts to them who have profoundly influenced our world, lives, and fortunes. But their acclaim and recognition come more from professional confrères than, as in the nineteenth century, from the public at large. Heisenberg and Schrödinger, the creators of the new quantum theory, have received a good deal of applause. But how many people know that Heisenberg, at least in his youth, played the piano almost like a stage artist, probably much better than Einstein his fiddle; or that Schrödinger struggled with the problem of the role of physics in biology, something Einstein never was concerned with? Kurt Gödel created in 1931 a law in logic[4] that would do honor to Aristotle (we will have occasion to invoke it towards the end of Part II). But who cares to know whether there is a baby photograph of Gödel around?

In sum, it seems to me that Einstein was the last representative of a species of folk heroes that is presently extinct, or at least invisible. And I do not quite know why this should so be, unless I accept Spengler's pronouncement that, in the West, the twentieth century would be epigonic to the nineteenth.

This one difference between the two centuries is perhaps more striking than profound; but there will be substantive ones too.

NOTES

1. See my article "Mathematics in Cultural History," *Dictionary of the History of Ideas* (New York, 1973), vol. III, p. 179.

2. In "History of Analysis," *Rice University Studies* **64**, nos. 2 & 3 (Spring-Summer 1978): 11-56.

3. Ibid., p. 15.

4. I mean the so-called "incompleteness theorem," that if a formal logical system is expressible within the arithmetical language ordinarily taught in secondary schools, then it includes assertions which can be neither proven nor disproven. See Andrzej Mostowski, *Sentences undecidable in formalized arithmetic; an exposition of the theory of Kurt Gödel* (Amsterdam, 1952).