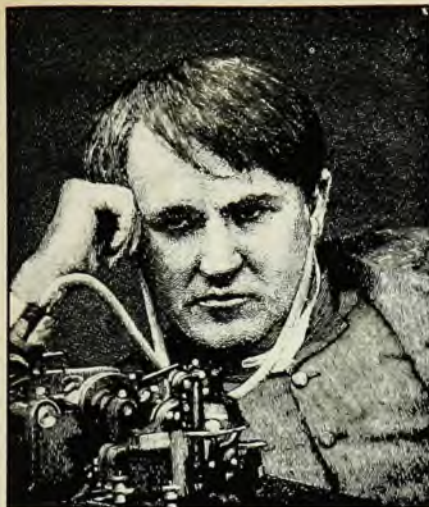




"The eminent Tom Edison brushed off alternating current as unreliable and dangerous."

Fortunately, *A Random Walk in Science* is much more than a lively compendium of contemporary scientific wit—or, some might say, witlessness. Digging back into the history of their subject, Weber and his editor-collaborator, Eric Mendoza of the Hebrew University in Jerusalem, have unearthed material not only about science's foibles, but about its more serious moments—for instance, F. Sherwood Taylor's classic account of the trial of Galileo: It was not simply a battle of "a champion of scientific truth against a reactionary church" but a far more complex struggle of personalities and ideas that is surprisingly relevant to our times.

In their selections, Weber and Mendoza also show that scientific writing has not always been a wasteland of calculated obscurity. Indeed, at times, it has even had a literary tone. As an example, they recall the advice of the 19th century mathematician, the Rev. Charles L. Dodgson, otherwise known by his *nom de plume* Lewis Carroll. "When I come upon anything—in Logic or in any hard subject—that entirely puzzles me," wrote *Alice's* creator, "I find it a capital plan to talk it over aloud, even when I am alone. One can explain things so clearly to one's self . . . one never gets irritated at one's own stupidity."

Stupidity, in fact, is another recurring theme of this book. In 1837, Weber and Mendoza note, the Surveyor of the Royal Navy loftily dismissed a proposal to propel a steamboat with a "screw-propeller" at its stern because it would be "absolutely impossible to make the vessel steer." Half a century later, the eminent Tom Edison brushed off alternating current as unreliable and dangerous. Nor are scientists alone singled out by Weber and Mendoza. Without any editorial comment of their own,

they quote a 1921 *New York Times* editorial chiding Robert Goddard for not knowing "the relationship of action to reaction—and of the need to have something better than a vacuum against which to react . . . knowledge ladled out daily in high schools."

More than anything else, however, this collection succeeds in answering a key question posed by William Cooper in his provocative introduction: "What is it that enables a set of clever men to live out there, having a high old intellectual time, on their own?" The answer is, as *A Random Walk* shows again and again, that scientists often display their creative genius even at play. Who else but a Gamow would have tagged the name of Hans Bethe onto a paper, even though he had nothing to do with it, simply so the authors could be listed as Alpher, Bethe and Gamow? No less creativity was displayed by the anonymous physicist who "proved," by Scriptural clues and the Stefan-Boltzmann law, that Heaven (525°C) is hotter than Hell (445°).

A Random Walk, in short, is an entertaining stroll behind the scenes of science, a backstage look at the shenanigans and foolishness, the frustrations and genius that so often remain hidden under the coldly logical language of scientific reports. Both scientists and nonscientists should enjoy taking this amusing and provocative excursion.

FREDERIC GOLDEN

Science Editor

Time magazine

New York, New York

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Note: A Random Walk in Science is available to members of AIP Societies from Marketing Services, AIP, 335 E. 45th St, New York, N.Y. 10017 for \$9.95 prepaid with checks payable to Crane, Russak.

Stable and Random Motions in Dynamical Systems

J. Moser

198 pp. Princeton U. P., Princeton, N.J. 1973. \$7.50

One of the older and more celebrated topics in astronomy and mathematics is the question of stability—stability of the solar system, stability of the Trojan asteroids and, more generally, stability in dynamical systems. On the other hand, in contradistinction to the predictability inherent in the notion of stability, there is the possible existence of random and erratic behavior of the masses. In the 1920's J. Chazy was forced, for technical reasons, to introduce such a motion in his study of the final evolu-

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tion of the three-body problem. He hypothesized, but did not establish, the existence of a motion where the sum of the distances between particles is alternately smaller than a predetermined constant, and then it becomes arbitrarily large. It is somewhat surprising, and at the same time it illustrates the complexities of nonlinear systems—that orbits exhibiting these two different types of behavior can coexist in the same dynamical system!

Over the last two decades some most important progress has been made in the study of both of these subjects. Basic contributions made by A. N. Kolmogorov, V. I. Arnold, and J. Moser have resolved some of the fundamental difficulties and reorganized the approach to stability. The importance of these contributions is underscored by a partial listing of their applications. For example, we now have a theorem asserting the stability of planetary systems for a majority of initial conditions and another asserting the stability of certain equilibrium positions for the infinitesimal particle in the circular restricted three-body problem.

About the same time, K. Sitnikov, following a suggestion made by Kolmogorov, established the existence of Chazy's oscillatory motion for the restricted three-body problem (a three-body problem where one of the particles has zero mass). V. Alekseev continued this study by taking a more general statistical approach to the problem and then showing the existence of solutions leading to a wide variety of random behavior.

These theories are incredibly rich. However, while the statements of these results, or at least statements of the applications of these results, are widely known, the details, proofs, history, and an appreciation for the inherent difficulties are not. (This is partially because some of the primary sources are most formidable and very difficult to read.) Consequently, Moser's monograph, which is the outgrowth of the Hermann Weyl lectures he presented at the Institute for Advanced Study, should be well received because it fills this need for a survey that is accessible (indeed, addressed) to the non-specialist.

Moser traces a selective history of stability in dynamical systems to illustrate first how stability is related to quasi-periodic motion, and then how the appearance of "small divisors" complicates this study. This provides the framework and motivation for a weaker, but successful definition of stability that is based upon the behavior of quasi-periodic motion. The main result provides conditions under which, maybe not all, but at least "most" solutions near an equilibrium point are well behaved.

He presents a different and conceptually simpler approach to the existence of random motion in the three-body problem. The main idea is to embed shifts on doubly infinite sequences into a dynamical system. In this way the existence of highly unpredictable orbits can be established. While the dynamical system used here is the three-body problem, by use of homographic solutions this result probably can be extended to an n -body setting.

The author's style makes the book most readable. Because he defers some of the more technical discussions to appendices, the book is well suited to be read either as a general survey, or as an introduction to the subject.

DONALD SAARI
Northwestern University
Evanston, Illinois

Ideas of the Theory of Relativity

M. Sachs

190 pp. Halsted, New York,
1974. \$9.95

Slender nonmathematical introductions to relativity—like vitamin pills—always seem to find a market, no matter what the contents. But publishers should be more selective. Mendel Sachs's avowed dual purpose is to explain the ideas of relativity "in an informal but detailed and explicit fashion" and to apply them to the problems of society. While Nobel Prize winner Konrad Lorenz has been criticized for applying his observations of geese to human nature, Sachs dares a much wider leap. For example, as he writes in his preface, "One of the most important developments of 20th century science that teaches us this philosophy [that every action in every day of one's life must be considered from the standpoint of the entire society] is the theory of relativity... For with this theory we have the implication that the world is continuously one—a closed system of inseparable components." This refers to Mach's principle, which links each particle's inertia to the rest of the universe.

However, the author admits he is no expert in sociology. Is he, then, an expert in relativity? He thinks, for example,

▶ that "a particular frame of reference may be inertial relative to a second frame, but noninertial with respect to a third" (page 22),

▶ that the existence of a universal speed follows from the relativity postulate (page 47),

▶ that length contraction is illusory: A moving meter stick could never fall into a 95-cm hole (page 63),