the calamity by his hunting activities. Both Kowalski and Vereshchagin are persuaded that man did not become effectively destructive to wild animals until the development of agriculture and animal husbandry, which went hand in hand with great increases in the human population.

Finally, two papers in the volume under review deal with subrecent faunal extinctions in Madagascar. R. Battistini and P. Vérin note that "Ecologic changes in protohistoric Madagascar" are complex in that they encompass both drastic changes in the vegetation of the island and the disappearance of numerous animal species. The authors conclude that man was certainly present when these processes began, and that he was largely responsible for them. Climate per se does not appear to have had much to do with these changes. On the other hand, they note that it "is apparent that the disappearance of the forest was a determining factor in the annihilation of certain species, among them the large lemurs." At the root of it all, however, the instrumentality of man seems certain. Alan Walker, in considering the "Patterns of extinction among the subfossil Madagascan lemuroids," generally supports the ideas developed by Battistini and Vérin. He stresses, however, that on the basis of knowledge of the morphology and inferred behavior of the large, extinct Madagascan lemuroids, these slow-moving, diurnal, terrestrial animals must have become extinct as a result of predation. Although environmental factors may have played some part in this process, Walker concludes that in "the absence of any large hunting carnivore, the pattern must be attributed to Man."

The book just reviewed offers an excellent summary of the problem as it stands today. The fact that the views still clash simply implies that we still do not have enough facts for a final assessment. Yet, if this reviewer may be permitted some additional comments, he would like to say this: it might be fruitful if, over and above such vital considerations as the paleontological evidence and the paleoecological setting, more attention be given in future inquiries into Pleistocene extinctions to the unique status of man as a reasoning and highly effective technological animal. Precisely his special, human status sets man apart from the rest of creation. He can and does master his environment, and against his "minding" and technological skills most other creatures are defenseless because, as Jelinek in this volume has pointed out, they are not adapted to cope with this higher order of being. Finally, it may also prove useful to investigate in some greater detail the question of differential gestation and maturation rates of some of the animals that became extinct. Inasmuch as many of these creatures appear, by analogy with modern representatives, to have been slow breeders, often with no more than single offspring, specific hunting practices that focused, for instance, on younger and immature animals might well have had disastrous effects on these species. Finally, the often demonstrably irrational hunting practices of aboriginal populations, especially in the case of herding animals that are also slow breeders, may have taken a toll far beyond what might be expected from the undoubtedly limited numbers of human hunters during the terminal Pleistocene.

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Vieta and Modern Algebra

Greek Mathematical Thought and the Origin of Algebra. JACOB KLEIN. Translated from the German edition (Berlin, 1934–36) by Eva Brann, with an appendix containing Vieta's *Introduction to the Analytical Art* translated by J. Winfree Smith. M.I.T. Press, Cambridge, Mass., 1968. xv + 360 pp. $12.50.

Geometry is a Greek word, and the subject is primarily of Greek origin; *algebra* is an Arabic word, but is the subject of Arabic origin? Al-Khowarizmi in the 9th century composed the *Al-jabr,* through which medieval Europe became familiar with the systematic solution of linear and quadratic equations, an operation which was given a symbolic form in the Renaissance. A key role in the modernizing of algebra was played in the late 16th century by Franciscus Vieta, and it is a reinterpretation of this role which Klein has presented. Klein argues that the *Ars analytice* of Vieta grew out of a generalization of the concept of number and that it stemmed from the syncopated *Arithmetica* of Diophantus rather than from the rhetorical *Al-jabr* of Al-Khowarizmi. A close philological scrutiny of ancient uses of such words as *arithmos* and *eidos* and *monas* leads the author to conclude that in its "theoretical logistic" of fractions one finds in the Diophantine arithmetic a more sophisticated concept of number than that adopted in the ordinary computation (logistic) which Plato had spurned. In this respect he feels that Diophantus is not far removed from views found in the three "arithmetical" books (VII–IX) of Euclid's *Elements.* The Diophantine numerical approach, supported by Platonic geometric analysis as described by Pappus, was, Klein believes, more appropriate as inspiration for the "symbolic concept of number" in Vieta's "general analytic art" than was the Arabo-Latin technique the very name of which Vieta disliked.

It is now more than 30 years since Klein first argued this case, persuasively and with close reasoning supported by full scholarly apparatus, in a journal of limited circulation. The original German text was published as "Die griechische Logistik und die Entstehung der Algebra" in the regrettably short-lived *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik,* Abteilung B: *Studien,* vol. 3, fasc. 1 (1934), pp. 18–105; fasc. 2 (1936), pp. 122–235. The present careful translation by the author's colleague at St. John's College, Annapolis, will make this erudite study, including almost a hundred pages of helpful notes, more widely available to scholars, and it should encourage further attention to a critical problem in the history of mathematics. Few doubt that symbolic algebra was a product of the Renaissance in Europe; but that age was buffeted by varied crosscurrents, of which the revival of classical thought, so eloquently argued here, was but one. The element of novelty or rebirth has perhaps been overstressed by Klein at the expense of the continuity of medieval influence represented by the 16th-century rules of "cosa" stemming from the Arabs. The application, in Vieta's "logistica speciosa," of arithmetic operations to quantities not necessarily numerical was not entirely novel; recently it has been pointed out [*Mathematical Reviews* **35**, 512 (1968)] that the 9th-century Muslim mathematician Thabit ibn Qurra had used the terms *multiplication* and *division* to denote operations performed upon quantities regarded as nonnumerical. Such adumbrations could have played a part in the "symbol-generating abstraction" of Vieta which here is seen as "mainly initiated by the reintroduction and assimilation of the *Arithmetic* of Dio-

phantus." In any case, it is to be hoped that someone before long will make as searching a study of Arabic algoristic impulsion toward modern algebra as Klein has made of Greek philosophical stimuli. Historians meanwhile will be grateful not only for the reappearance of Klein's study in a more convenient form, but also for the very welcome inclusion (in an appendix, pp. 313–353) of a long-desired English translation of Vieta's *Isagoge in artem analyticam*—the chief contribution made by "the true founder of modern mathematics."

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Surfaces and Interactions

The Cell Periphery, Metastasis and Other Contact Phenomena. LEONARD WEISS. North-Holland, Amsterdam; Wiley, New York, 1967. 388 pp., illus. $17.50. Frontiers of Biology, vol. 7.

It was once expected that the insights into control mechanisms derived from the study of single cells would be immediately applicable to the mammalian cell. One of the principal difficulties—both technically and theoretically—in exploiting these gains has been evaluating the importance of cell-cell interactions. It has always been appreciated that the physiology of cells, with respect to rates of reactions, must be determined by the highly organized environment existing in tissues where cells are closely and precisely juxtaposed. Many biologists, however, from the very beginning of the studies with single cells of higher organisms, have reserved the further possibility that the cell was regulated also at a primary level and that "contacts" in some way determined the biological capacity of the cell. Whether with respect to the regulation of physiological processes or to the determination of the biological potential of the cell, an increasing number of phenomena, such as induction, morphogenesis, immunological responses, contact inhibition, and metastasis, are being considered as determined by "contacts."

It is therefore particularly useful that there has appeared at this time a comprehensive, sound, and clear account of what is known about that part of the cell—the cell periphery—which is involved in contacts. Weiss has reviewed the chemical constitution of the surface, as now known, and given some account of physical and physiological dynamics in the peripheral zone. The various theories that have been advanced to explain cellular aggregation are considered. These include possible formation of antigen-antibody-like complexes, pairing or coordination involving cations, and stabilization of cells at critical distances by virtue of secondary minima that exist, theoretically, in the potential fields between identically charged particles in close contact. The experimental details given demonstrate the techniques and the inadequacies of many of the techniques needed for studying cells isolated from tissues.

Some of the physics and physical chemistry of the interaction of charged particles, mostly derived from studies of lyophobic colloids in dilute solutions, is given as a possible basis for understanding cellular interactions. The larger size of the particles, that is, the cells, and the concentrated nature of the solutions in which they interact are only a few of the formidable problems involved in the application of studies from simpler systems. The very valuable technique of cell electrophoresis, so beautifully exploited by Weiss himself, is described in considerable and useful detail.

It would be hoped that the vast quantity of data accumulated would permit an understanding of the molecular basis of cellular contacts and of any behavioral or functional changes. Perhaps the most valuable aspect of Weiss's presentation is the judicious (and gentle) way he has indicated that there are not enough data on any aspect of any problem to permit one to come to any conclusion. This is important, for many have accepted conclusions, especially concerning differences between normal and malignant cells in respect to surface properties, charge densities, and chemical constitution, without appreciating the limited nature of the available data or the technical and theoretical difficulties involved in obtaining and interpreting data. The detailed consideration of some of the findings from which conclusions have been drawn is perhaps the best way to reveal the nature of the difficulties.

The greatest difficulty in the field in general would appear to be the communication gap that exists between the biologist and the physical chemist working on these problems. The biologist describing behavior of cells—for example, movement at epiboly—rarely reports ionic strength or any physical constant which would be useful to the physical chemist trying to formulate mechanisms. On the other hand, the physical chemist uses models—for example, one using rigid steel plates to elucidate potential changes on interaction of charged particles—whose value is not appreciated by many biologists. The inadequacy of our present understanding of contact phenomena is thus due not only to the absence of critical information and to the complexity of the situation but also to a lack of appreciation of what each of the two disciplines can offer. Weiss's presentation should help to reduce this communication gap and make for a more productive effort between the two groups—one which may very well reveal an important mechanism of control peculiar to higher organisms.

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Medical Historian

Henry E. Sigerist: Autobiographical Writings. Selected and translated by NORA SIGERIST BACON. McGill University Press, Montreal, 1966. xiv + 247 pp. $5.75.

Few individuals have influenced the field of medical history in the United States as much as Henry E. Sigerist (1891–1957). Director of the Johns Hopkins Institute of the History of Medicine from 1932 until 1947, Sigerist affected countless physicians, founded the *Bulletin of the History of Medicine*, contributed to the reorganization of the American Association for the History of Medicine, and gave powerful impetus to the development of medical history as an aspect of American scholarship. His interesting life and diverse activities make this volume, containing an unfinished autobiography and diary entries, rewarding reading.

The autobiography furnishes an account of the formation of a medical historian. Educated in the classical tradition, Sigerist's humanistic orientation persisted throughout his medical training, causing him some concern until he discovered, in medical history, a field in which he could combine his various interests. After postdoctoral study with Sudhoff, Sigerist succeeded him to the chair of medical history at Leipzig's Institute of the History of Medicine. Later, anticipating Hitler's rise to power, Sigerist acceded to William Welch's