amniotic fluid and the analogy between plants and animals. Malpighi's ideas are examined in detail and then compared to those of other students. Again, texts are quoted in profusion and the reader is treated to a detailed historical study which moves backward and forward in time from Malpighi. Von Baer and Haller, Aristotle, and Fabricius, together with numerous other well-known and little-known figures in the history of embryology, make their appearance in these studies.

The tabulation of "literature cited" covers 80 double-columned pages, with original sources and monographic studies both included. This excellent bibliography is clearly the backbone of this work. No reader has any excuse for being lost in the embryological literature any more. Although the index of 140 pages is well constructed, the reader is put to some inconvenience because the index does not give volume numbers, the pagination through the five volumes being continuous.

Students of the history of biology and colleagues of Adelmann have known for some years that he was hard at work upon a study of Marcello Malpighi. Few would have guessed the size and scope of the finished product. One might complain that the high price of the work will keep it out of the hands of some of those who might most enjoy it, but no one can deny that through his prodigious labors Adelmann has put all those with an interest in the history of biology in his debt.

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Superconductors

The past decade has been one of exciting developments in the field of superconductivity. Foremost has been the emergence of a useful microscopic theory which has provided a quantitative interpretation of many of the principal superconducting phenomena. Significant experimental discoveries have included flux quantization, type II superconducting behavior, and a rich variety of tunneling effects. An important technological advance has occurred through the application of type II superconductors in the construction of loss-free, high-field electromagnets. It is hardly surprising that these developments have rendered somewhat obsolete the monographs on superconductivity published some 15 years ago by Shoenberg and by London. There is now a pressing need for some up-to-date treatises encompassing recent advances in the field.

P. G. de Gennes's **Superconductivity of Metals and Alloys** (P. A. Pincus, Transl. Benjamin, New York, 1966. 288 pp., illus. $12.50) is responsive to this need. The book focuses attention upon two general areas in which great progress has occurred recently, the microscopic theory of the phase transition and the origin of the two magnetically different classes of superconductor now labeled type I and type II. Although a full treatment of these topics would hardly be possible without the use of the advanced formalisms of modern solid state theory, de Gennes appears to have made an effort to utilize these techniques sparingly and to maintain a viewpoint which is on the whole more physical than mathematical. For this experimentalists will be grateful.

The first three chapters treat some of the basic characteristics of superconductors. The starting point is a rather brief discussion of thermodynamic and electrodynamic properties, made plausible in terms of an assumed condensation of the electron gas. Type I and type II magnetic phenomena are then dealt with in separate and more detailed chapters, including penetration depth and intermediate state effects in the former case and vortex structure, pinning of fluxoids, and flux creep phenomena in the latter. In chapters 4 and 5 the assumed electron condensation is analyzed from a microscopic viewpoint, following the Bardeen-Cooper-Schrieffer and Bogolubov methods. This includes a discussion of gauge invariance, flux quantization, and the origin of the Meissner effect. Chapters 6 and 7 introduce the Landau-Ginsburg equations and their application to bulk material, thin films, and various types of superconducting junctions. The book concludes with a brief discussion of magnetic impurities and gapless superconductivity. Despite a substantial number of misprints and algebraic errors in the text, *Superconductivity in Metals and Alloys* can be recommended as a useful and perhaps even essential addition to the library of the advanced student of superconductivity.

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Matrices

Charles C. Cullen inaugurates his disquisition **Matrices and Linear Transformations** (Addison-Wesley, Reading, Mass., 1966. 237 pp., illus. $8.95) by considering matrices *qua* matrices, as opposed to matrices as representations of linear transformations over a finite dimensional vector space with a preferred basis. In view of the very modest prerequisites assumed for the student, and the author's expressed desire to cover fairly rapidly topics most frequently met in engineering and physics, this seems sensible. Mathematical pedagogy being an experimental science, only classroom testing will show whether this approach is sound.

There is nothing in the book that cannot be found in one or another text, but I recall no other text written for so general a group of students that contains precisely this material and follows this mode of presentation. Linear spaces and linear transformations are treated and used, as are determinants, and the classical canonical forms of a matrix are obtained. Less usual is the inclusion of a chapter on functions of matrices and another on solutions of the equation $AX = XB$, involving iteration. More than common emphasis is placed on actual computation, interpolation, characteristic values and vectors, and, generally, devices of interest in applications. Nevertheless, the book may be regarded as "pure" in the sense that specific subjects of a physical nature are not presented in that language.

I take only the position that the text is worth trying, but is unlikely to be entirely successful for students with the very small number of prerequisites suggested by the author.

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Inclusions in Minerals

Because Soviet geologists have placed unparalleled emphasis on research on solid, liquid, and gaseous inclusions in minerals, the appearance of a book summarizing their results is important to scientists interested in natural mineral-forming processes. **Research on the Nature of Mineral-Forming Solutions** (Pergamon, New York, 1965. 747 pp. illus. $25) is a translation by V. P. Sokoloff, edited by Edwin Roedder, of three Russian publications. The first

of these, *Studies of Mineral-Forming Solutions*, by N. P. Yermakov, forms part I and fills nearly half the book. Parts II and III are translations of the journal *Research on Mineral-Forming Solutions*, volume 1, part 2, and volume 2, part 2, both edited by Yermakov.

After a discussion of mechanisms causing formation of inclusions, a classification scheme is presented to aid in the critical but often subjective discrimination between primary inclusions and those formed after the host mineral. Examples are given of inclusions, ranging in size from microns to 6 centimeters or more, in over 50 minerals. In most cases, inclusions contain two or more phases.

Fluid inclusions are useful only if they remain hermetically sealed throughout geologic time. The controversy found in our literature on this topic should be settled by the extensive evidence here presented, from both natural and synthetic inclusions, demonstrating that at least the predominant components of inclusion-fluids are retained nearly permanently. The interpretation of an inclusion is limited, however, because "only the temperature, but certainly not the composition of the captured droplet could have been the same as that of the mother liquor" (p. 49). In accord with this precept, compositions are largely neglected in favor of methods of evaluating the temperature of crystallization of the host mineral. Decrepitation is discredited, but the method of homogenization of phases (for transparent minerals) appears to give only slightly low temperatures, although corrections must be considered.

Descriptions of apparatus used in heating minerals while observing inclusions are slanted toward Soviet components and are of little value, particularly since commercial units are now available.

An interesting variant to these studies has been the measurement of volumetric phase ratios versus temperature. This technique offers easily acquired data directly related to "gross compositions"; such data are interpretable provided that sufficient volumetric data on pertinent solids and fluids become available. There is no discussion in the book of the utility of freezing-point determinations as used in this country.

The valuable information afforded fills only about half the volume; it is diluted by verbose and imprecise prose (apparently not the fault of the translation), by overly repetitive examples, by extraneous philosophizing, and in part I by frequent doses of propaganda. For example, errors are usually attributed to Americans, progress to Soviet geologists: "American geologists, whose concepts . . . tend towards simplification and emasculation . . ." (p. 293), ". . . creative daring of the young Soviet geologists . . ." (p. 297), and ". . . liberation from concepts alien to the Soviet school . . ." (p. 297).

The basic scientific method of the authors may be criticized on several counts. Few numerical data are given, and the derivation of values is often at least obscure. Quantitative evaluation of uncertainties is very rare indeed. The figures occasionally lack units for coordinates or on contours; graphs in parts II and III often present experimental curves without data points. My confidence was also shaken by such statements as "heating serves to reduce the volume of the vacuole wherein the inclusion is confined . . ." (p. 73).

Although the scientific quality of this book is only mediocre and the price seems excessive, purchase is warranted in the absence of another text on mineral inclusions.

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Mammoth in situ

No natural history museum worthy of the name lacks its display case of mammoth or mastodon teeth or its diorama of the "Great Ice Age" mammals. But to see the bones of such creatures exposed in the beds where they occur naturally, let alone to share the excitement of the "dig," one must be or travel with a paleontologist or amateur collector. To my knowledge there is no permanent public display of mammoth bones with artifacts of Early Man in a natural outcrop anywhere in the United States.

Domebo, named for its owner in southwestern Oklahoma, would not have been an easy fossil site to stabilize for such a purpose. The excavation team had its hands full mapping, jacketing, and removing mammoth bones before the spring thaws slumped over the site. **Domebo, a Paleo-Indian Mammoth Kill in the Prairie-Plains** (Contribution No. 1 of the Museum of the Great Plains, Great Plains Historical Association, Lawton, Oklahoma, 1966. 63 pp., illus. Paper, $2.50), edited by F. C. Leonhardy, treats the geology (Retallick and Albritton), paleontology (Slaughter and Mehl), archeology (Leonhardy and Anderson), malacology (Cheatum and Allen), and palynology (Wilson) of beds containing bones of a single subadult, probably female, Imperial Mammoth (*Mammuthus imperator*). Found with the bones were three projectile points, one of Clovis fluted type and one approaching the Plainview type. Carbon-14 dates on the organic fraction of the mammoth bone give its age as 11,200 years. Twelve species of small vertebrates and 30 species of molluscs were removed from associated beds. Part of the fauna cannot be regarded as contemporaneous, as it came from beds 1000 years younger than the mammoth itself. But the pollen diagram by Wilson indicates no major vegetation changes throughout this interval, and the environment 11,000 to 10,000 years ago may have been quite similar to the present one.

Although the information they contain bears directly on a leading controversy in paleoecology—the cause (or causes) of late Pleistocene megafaunal extinction—few single large mammal sites have received the careful attention devoted to the Domebo mammoth. Paleoecologists need many more case histories of this sort. And the public and the scientist both may hope that among future discoveries one showing bones, artifacts, stratigraphy, and ancillary evidence will prove suitable for a permanent exhibit *in situ*.

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Motion of Fluids

Basic Developments in Fluid Dynamics, volume 1 (Maurice Holt, Ed. Academic Press, New York, 1965. 459 pp., illus. $17.50), consists of five articles on topics of current interest. "The numerical solution of problems in gas dynamics," by O. M. Belotserkovskii and P. I. Chushkin of the Computing Center of the Academy of Sciences of the U.S.S.R., describes three numerical methods of solving nonlinear partial differential equations used mostly in gas dynamics, namely the method of finite