# Book Reviews

## Embryology: Malpighi and a Persisting Question

The biochemist James Bonner prefaced a recent monograph with a call to action: "The time has come for a direct attack upon the central problem of biology, the problem of how it is that a single cell, the fertilized egg, gives rise to an adult creature made up of many different kinds of cells." His words reflect the confidence and the impatience of today's biologists. But there is probably no problem in the history of biology that has so consistently engaged the attention of biologists as the process of development. Every era from antiquity to the present has been witness to new explanations, and many a biologist has made his reputation by advancing new proposals or by describing new evidence. Perhaps the rapid advances made in recent decades in understanding the nature of life itself hold promise of providing an explanation which has hitherto been denied to biology. Today's biologist, viewing the complexities of the developmental process, will certainly be able to appreciate the study under review here and the record it provides of an early step toward an understanding of the process.

During the year 1672, Marcello Malpighi forwarded to Henry Oldenburg, Secretary of the Royal Society of London, two slight manuscripts, *De Formatione Pulli in Ovo* and *De Ovo Incubato Observationes*. These two short treatises on the development of the chick embryo form the core and the cause of Howard B. Adelmann's mammoth five-volume **Marcello Malpighi and the Evolution of Embryology** (Cornell University Press, Ithaca, N.Y., 1966. 2567 pp., illus. $200). Malpighi, who adapted the microscope to anatomical studies and who had already been credited with the discovery of the role of the capillaries in circulation of the blood, provided in his embryological tracts some of the best studies of the early steps in the development of the chick embryo. Although focusing upon Malpighi, Adelmann has ranged far and wide in this impressive work and has provided a many-faceted analysis of the history of embryology.

The Cornell University Press has spared no expense in the production of the work, and it clearly has let the author set his own limits. Volume 1 is a biography of Malpighi. Adelmann has examined numerous manuscript sources and has obviously ransacked the printed literature as well. One is overwhelmed by the 725 folio pages of biographical detail, and certainly appreciative of the light that it casts not only on Malpighi but also on the numerous other 17th-century Italian scientists, and indeed upon the scientific life of Italy as a whole.

Most authors would have considered that their job was done upon the completion of a biography of such great scope, but Adelmann has just begun. Volume 2 opens with several brief chapters which trace the main currents of embryological thought up to the time of Malpighi. These chapters are really a sketch and are not meant to be considered a detailed history. Adelmann begins his close analysis with the 100-page section entitled "Malpighi's Contribution to Embryology."

Almost every major embryological work referred to is quoted at length, in English, in the text, with the footnotes presenting the same material in its original language. Even longer selections are appended to several of the chapters, with the original text and the English translation in parallel columns. Thus we have selections from Gassendi, Harvey, Haller, Everard, and Fabri. Reading these chapters is just like following the author as he conducted his research, for it almost seems that he has set down many of his notes, jottings, and citations, as well as his narrative and interpretation. This is extremely helpful for judging Adelmann's accuracy, although one can become lost in the detail and the lengthy quotation.

Adelmann leaves the reader with the picture of Malpighi as an anatomist of consummate skill in his dissections and manipulations. Through careful analysis of the tools at Malpighi's command, including a special section on his microscopes, we are given a very good idea of what it meant to be an anatomical investigator in the latter half of the 17th century. There is one special question on which Adelmann wishes to set his readers straight. This concerns Malpighi's position in the controversy between epigenesis and preformation as explanations of development. Adelmann feels that Malpighi has suffered at the hands of earlier historians who "inadequately understood" the speculations he advanced. It would seem that Malpighi, while still identifiable as a preformationist, cannot really be cast with the many other proponents of this viewpoint in that he did not carry these ideas to the extreme of such notions as encasement or *"emboîtement."* Adelmann claims that if Malpighi is read carefully enough, it is clear that he believed that there *was* new production taking place during development, a view which would tend to put him in league with William Harvey and other proponents of epigenesis. What little evidence there is Adelmann has dug out, and although at times one has the feeling that he has become too closely identified with the figure under study, his point seems well taken.

At the close of the second volume, the two embryological treatises are set out with Latin and English on facing pages. The critical apparatus is contained in footnotes, which average between one quarter and one third of every page. It is fair to say that there is hardly a word of importance which goes unnoticed, and the tracks which Adelmann provides to the rest of the embryological literature will certainly be helpful to any reader who wishes to examine Malpighi's ideas in their historical context. The eleven anatomical plates which Malpighi prepared to accompany his manuscripts are included as foldouts.

The three remaining volumes contain, in addition to the index and bibliography, a bonus of some 1200 pages in the form of "excursuses." As if the lengthy biography and the detailed prefatory notes and commentary on the manuscript were not enough, Adelmann sets out to share with his readers the gleanings of his many years of study of the history of embryology. Each excursus addresses itself in detail to one of the special topics that Malpighi has treated in his works. These range from the brain, the wings, the heart, and other organs to such special topics as the

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