Book Reviews

The Whole Man Harvey

William Harvey's Biological Ideas. Selected Aspects and Historical Background. WALTER PAGEL. Hafner, New York, 1967. 394 pp., illus. $25.50.

The Life of William Harvey. GEOFFREY KEYNES. Oxford University Press, New York, 1966. 501 pp., illus. $14.40.

We are accustomed to think of Harvey as a Modern. To biology he brought scrupulous experimental technique and quantitative reasoning. The measure of his success was the replacement of the ancient Galenic physiological doctrine by a new view of the movement of the blood and concurrent and subsequent revision of all our notions regarding cardiac action, respiration, and nutrition. Biology, continues this wan truism, thereupon joined the revolutionary intellectual events of the 17th century and became a true science. It is a good tale and one not wholly false, but it nonetheless is misleading and is only a partial assessment of Harvey's great adventure.

Aristotle had assigned to the heart supreme position in the body; Galen attributed this place to the liver (and brain). To Aristotle the blood was one; to Galen venous blood from the liver was elaborated, in the heart and by addition of *pneuma*, into arterial blood. To both, however, blood was a matter of fundamental physiological concern. It was the essential nutrient of life. It was also the vehicle, to say no more, for the vital spirits whose presence and activity alone assured a truly animal existence, by Aristotle's definition a mode of life including growth, locomotion, and perhaps rudimentary sensibility. Blood, therefore, was purposeful. At once nutritive and spiritual, it enjoyed a definite place in the order of things, however differently that order might be conceived. The physiologist *qua* reflective natural philosopher willingly sought out the end for which these substances and processes were contrived. One's preferred natural order might be the rejected Galenic physiological schema or, equally well, a fresh conception in which the whole mass of the body's blood endlessly traveled through arteries and veins, turning always a full circle and impelled by the beat of the heart. Such was Harvey's conception, and he no less than his predecessors asked that same critical question: For what *purpose* was this splendid apparatus devised?

Recital of anticipations of discovery, a record of advances which we today hold as valid, the overlooking of blunders and of strange forms of thought—these are the incubi of Harvey scholarship. On Walter Pagel, however, they have had little hold, and his extraordinary study of Harvey's biological ideas is both revelation and triumph. He has sought the whole man Harvey and therefore demands, as one must, the "internal reason" for Harvey's insistence upon circular symbolism, purpose in nature, and the divine aspects of generation. Pagel's endeavor and conclusions may invite robust denunciation by men of strongly positivist leanings; those with a taste for the unexpected and seemingly bizarre in the ways of thought will be generous in their praise.

Harvey, singular and profound thinker, possessed both the idea of circulation and the will and inventiveness to bring forward confirmation of that idea. Confirmation Pagel assigns to experiment and quantitative reasoning (Harvey's comparative anatomical studies regrettably are overlooked). This is an orthodox conclusion and is, moreover, somewhat incidental given the fundamental trend of Pagel's argument. So much, then, for confirmation. What about the discovery itself, the *idea* of an overall pattern of heart motion and blood circulation?

This idea Pagel traces principally to the doctrine of circles. Harvey is placed in the mainstream of late Renaissance speculative thought, predominant in which was the famous cyclical philosophy cast by Plato and modified by Aristotle and generations of Neoplatonists. Phenomena, according to this view and in spite of appearances, return ever upon themselves and pursue essentially the same course of change upon each return. Such is the behavior of the planets in the heavens, of sun and storm, of seasons of the year, and of species and individuals of animals and plants. Most noteworthy was the microcosm-macrocosm analogy by which the processes of the human body, the microcosm, were closely attuned to the great external world, above all to celestial events, the macrocosm. Harvey, it is well known, makes much of this analogy. Others before him, however, had explicitly joined body and cosmos and derived from the comparison a new view, without evidence, of course, of the behavior of the blood. Giordano Bruno, from the regal positions of sun and heart and the micro-macrocosmic analogy, had postulated the existence of a circular movement of blood in the body. Robert Fludd, Harvey's acquaintance and the first to offer published support (1629) of his discovery, approached circularity on a related but distinct track, that of the chemist. Fludd's "mystical anatomy of the blood" urged a rhythmic repetition of blood movement (but by no means circulation in our sense); the analogue was the cycle of evaporation and condensation in the distillation process. Blood and water ceaselessly followed the same round. From such influences, and particularly the views of Fludd, Pagel urges us to conclude that Harvey's idea was logically and, presumably, chronologically prior to his more famous experiments and numerical argument. Harvey's idea is, therefore, more likely the product of reflection on and borrowing from the current metaphysical idiom than a consequence of experimental investigation, quantitative reasoning, or consideration of the role of venous valves, Harvey's own account of his discovery.

Harvey's estimate of the relative importance of heart and blood seems to support this conclusion. Departing from Aristotle, his master, Harvey postulated the supremacy of blood. It appeared first in embryonic development, and to it was assigned (in Harvey's later writings) the innate heat of the body. According to Galen the distribution of blood throughout the tissues leads to its consumption. But if the blood is truly the seat of life, as Harvey dis-

tinctly implies, Pagel suggests that we have an additional and powerful argument favoring circulation. The blood is supreme, of "high priority and dignity" and is also the "source of the heart." It cannot, therefore, suffer real loss. The only way to prevent loss is to return to its focus (the heart) and there begin its course anew; hence circulation is necessitated by the nature of the blood itself.

Perfection and Generation

The doctrine of circles, moreover, permits us better to assess Harvey's conception of the purpose of circulation. Circular motion is more *perfect* than any other conceivable motion just as, Aristotle and the Neoplatonists claimed, the circle is the most perfect of all forms. It is at once complete and eternal, lacking both beginning and end. On this account alone circulation of the blood proves superior to the ebb-and-flow movements proposed by the Galenists. But further, circulation in an important sense is a generative act—it nourishes and maintains an ever-changing organism—and therefore partakes of the highest of all organic functions. "The nature of generation and the order that prevails in it are," said Harvey, "truly admirable and divine, beyond all that thought can conceive or understanding comprehend." Circulation of the blood thus finds a *raison d'être* in its concordance with the cyclical order of nature.

Pagel's argument expands into several related topics. He provides a superb discussion of Harvey's devoted adherence to vitalism, binding it to the epigenetic view of development (a union persisting, in the ideas of Driesch, into the 20th century) and to the Stoic monistic conception of matter and spirit. The opinions of the Paracelsian epigenesist Peter Severinus and those of Marcus Marci, proponent of a remarkable optical theory of epigenetic development, are fully expounded and possible connections with Harvey's thought explored. A large section of the book is devoted to Harvey's predecessors; the author's conclusions are independent and clear, although his analysis is occasionally painful in its thoroughness. Pagel's study of the great 16th-century Aristotelian Cesalpino is uncommonly careful and complete and permits us finally to form some estimate of the character of his exceedingly ambiguous views on the movement of the blood.

This book is easily the most important and provocative reevaluation of Harvey's biological ideas to be published in our generation. Its author accepts and examines the traditional impression of Harvey as master experimentalist and mathematical practitioner. His reach, however, goes further, and he grasps the underlying assumptions and metaphysical position which are no less relevant to Harvey the physiologist. Pagel's discussion, moreover, forces upon us once again a realization that the Scientific Revolution must not be judged wholly by the progress of the physical sciences, nor may it be rightly epitomized as an assault upon Aristotle, occult qualities, and final causes.

Medical physiology had long been Galenic and, when the reaction came, a coherent theoretical consideration of the great problems of living things could be found in but one place, the writings of Aristotle. Harvey was only one in an age of ripening biological Aristotelians. The ascendancy of function over form and the functional integrity of the organism, the quest for purpose in living things (consummate folly in the eyes of Harvey's real and justified intellectual foe Francis Bacon), concentration upon generation and development as critical biological issues, scepticism with regard to a genuinely natural classification of plants and animals—these and other matters all flow from the Stagirite's astonishing achievement. His influence in the 17th and 18th centuries was enormous, overwhelming all other systems. Aristotelians in the broadest sense include John Ray, the Comte de Buffon, Albrecht von Haller, John and William Hunter, Georges Cuvier, and Johannes Müller. This succession begins probably at the University of Padua and most conspicuously with Harvey's distinguished mentor Fabricius ab Aquapendente. It had matured fully in Harvey's thought, and to Pagel we may fortunately turn to read its consequences. To my knowledge the role of Aristotelian thought in the emergence of the modern science of biology has never been systematically recorded.

The Biographical View

From Pagel, whose objective lies elsewhere, we learn little of Harvey's life and professional concerns. Such information, however, is ours in abundance in the amiable biography by Geoffrey Keynes. This highly readable work is a treasure-house of data pertaining to Harvey, perhaps the most complete such collection ever made. There are seven appendices, and numerous documents appear in the text. The treatment is chronological. Harvey's education in England and Italy, his appointment to St. Bartholomew's Hospital and election to the Royal College of Physicians, his travels, his close relationship to the first Stuart kings, the design and preparation of his great books (*De motu cordis,* 1628; *De generatione animalium,* 1651), his friends, enemies, and sizable and affluent family, and his support of the royal cause during the Civil War are fully discussed. Of exceptional interest is Keynes's description of Harvey's medical practice and his rather low contemporary reputation as a practitioner. Keynes also provides ample and new information regarding Harvey's activities at the College of Physicians, whose interests and welfare he relentlessly encouraged.

Keynes hoped only to follow Harvey "on his passage through this world," and this volume testifies to his success. He deals with intellectual biography only insofar as it pertains to this objective. His view of Harvey the biologist is notably unlike that of Pagel and is wholly traditional. A striking curiosity recorded by Keynes is Harvey's activity as Censor at the College of Physicians, in which post Harvey the ardent Aristotelian tested aspiring physicians on their mastery of Galen. On this seemingly anomalous situation Keynes remains silent.

The Life of William Harvey and *William Harvey's Biological Ideas* are complementary volumes and deserve to be read by all concerned with the development of biology and medicine and with the general structure and formation of scientific thought. Harvey the man and physician betrays much of the state of medicine and medical practice in early modern times; Harvey the thinker illustrates persuasively that there is more to scientific advance than hardware, facts, and patience. We touch here one of the classic instances of bias, presupposition, and metaphysics in their creative role. Scholars ill serve themselves who will reject or ignore this lesson.

WILLIAM COLEMAN
Department of the History of Science, Johns Hopkins University, Baltimore, Maryland