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William Harvey and modern cardiology

The 400th anniversary of the birth of William Harvey will be commemorated in many ways, not the least being a symposium at the Royal College of Physicians in July. There not only will the historical context of his work be re-examined, but modern cardiology reviewed. None of this could have been achieved without his crucial discovery of the circulation, now so obvious to all and so much taken for granted in the work of every physician and surgeon. Certainly, some valuable observations made after his time do not depend on his demonstration of the circulation of the blood, but these are remarkably few. Medicine was an entirely different philosophy before Harvey, and from his day onward became a science as well as an art.

It is strange to think back to pre-Harveian times, when the whole basis of our knowledge of medicine depends on him. As we have been reminded in recent years, the wonder is not so much that Harvey made his discovery but that the Greek, mediaeval, and renaissance physicians and anatomists had failed to do this.[1 2] The publication of *De Motu Cordis* in 1628 was a watershed; the book well repays study by those working on the circulation today, and is most easily readable in Whitteridge's recent retranslation.[3]

Can we imagine what would have happened without Harvey's discovery? It would not, presumably, have been unduly long delayed, for the time was surely ripe; but then, it found the right mind. Certainly, Withering would still have been able to introduce digitalis, but it required the scientific background of Harvey's discovery to enable its mechanism to be worked out and the pharmacological management of heart failure to be understood.[4] Likewise Lauder Brunton empirically introduced amyl nitrate for angina[5]; the disease and its remedy, though better understood, have still not yielded all their answers despite continuing investigation.[6]

Last year the catalogue was published[7] of the late Evan Bedford's cardiological library, which now adorns the Royal College of Physicians of London. The first 17 pages are devoted to the pulse, that "organ" so favoured and discussed by pre-Harveian philosophers and physicians, but even the majority of these contributions postdate Harvey. A substantial section of the catalogue is devoted to the works of Harvey himself and the discovery of the circulation of the blood. Even more telling is the evidence in that essential collection of significant contributions to cardiology by Willius and Keys.[8] As they indicate in their preface: "The first classic included in this volume is the epoch-making contribution of William Harvey, published in 1628. We have deliberately avoided earlier writings, being convinced that Harvey's work is in reality the fundamental contribution on which the modern concepts of the anatomy and the physiology of the heart and circulation are based. Genuine progress in the field of cardiology first became evident when the views of Harvey became generally accepted." There is no clearer or more accurate exposition of the factual basis for cardiology than these three sentences.

Looking back 400 years to the time of Harvey's birth, how can we in 1978 relate the modern techniques at our disposal to the report that was published when he was 50 years old? At the simple critical level of recording the pulse, we may dispose of ancient interpretations, but it was little more than a hundred years ago that the correlation between the rhythm and rate of cardiac activity and the peripheral pulse could be applied clinically.[9] Correspondingly, it would have been futile for Laennec to have introduced auscultation of the heart sounds without the basis for their correlation with valvular behaviour and the contraction of the heart.

Within the last four decades we have seen the introduction of cardiac catheterisation, angiocardiography and coronary arteriography, and intracardiac electrophysiological studies; the knowledge that these have produced and the diagnostic and therapeutic developments all rest firmly and exclusively on the foundations laid by Harvey. Unless, as with digitalis, medications were noted by chance to produce improvements in symptoms and signs, there would have been no progress in the management of heart disease. Correspondingly, the dependence of every organ system in the body on the circulation implies the identical consequences. And even if we had had medications for treating, for example, angina, we would not have been able to define their mechanisms, or to understand whether their circulatory actions were peripheral or central, without knowing the essence of the circulation itself. Now, paradoxically, we find ourselves better able to study the circulation without the need for catheterisation in many cases, as technological innovations since Waller[10] have permitted the assessment of the circulation by electrocardiography, phonocardiography, ultrasound, and what Wood has described as "tomographic vivisection."[11]

Important though all these developments are, by themselves they constitute no more than a dry list. Harvey's contribution,

however, is far greater than the sum of all the measurable parts that follow from his work. For on his courage in facing the facts of what he had seen, and describing them, at a time when Galileo and others had found this approach to be unfashionable and indeed dangerously heretical, William Harvey set a standard for all medical scientists. Boerhaave could not have laid the foundations of clinical practice a century later without the impetus from Harvey's observations that led medicine out of the dark ages. Anaesthesia could not have developed without the knowledge that inhaled gases could reach the brain and induce unconsciousness; sound pharmacology also derives from the knowledge that drugs, given by mouth or injection, will be carried by the circulation to the organs on which they must act; and many of our diagnostic techniques fall into the same category. As this year we commemorate Harvey's 400th birthday, we are aware that the solution of many problems in medicine depends on even better refinement of the basic understanding of circulatory processes.

As physicians and others gather in London and Folkestone to commemorate Harvey, they will remain conscious of the important thread that comes back over the 350 years since the publication of *De Motu Cordis*: sterile philosophical debates on the function of the heart and lungs were effectively demolished by the careful scientific observations of a man of genius; technical methods may improve, but the quality of the mind and the way it was used set the scene for progressively unravelling many of the answers to medical problems. The greatest error we can make will be to fail to recall the lesson of careful observation and logical interpretation for which we are indebted to William Harvey.

[1] Harris, C R S, *The Heart and Vascular System in Ancient Greek Medicine*. London, Oxford University Press, 1973.
[2] Whitteridge, G, *William Harvey and the Circulation of the Blood*. London, Macdonald and Company, 1971.
[3] Harvey, W, *An Anatomical Disputation Concerning the Movement of the Heart and Blood in Living Creatures*, trans G Whitteridge. Oxford, Blackwell Scientific Publications, 1976.
[4] McMichael, J, *Pharmacology of the Failing Human Heart*. Oxford, Blackwell Scientific Publications, 1950.
[5] Brunton, T L, *Lancet*, 1867, **2**, 97.
[6] Julian, D G (ed), *Angina Pectoris*. Edinburgh, Churchill Livingstone, 1977.
[7] *The Evan Bedford Library of Cardiology*. London, Royal College of Physicians, 1977.
[8] Willius, F A, and Keys, T, *Cardiac Classics*. St Louis, C V Mosby, 1941.
[9] Lorain, P, *Etudes de Médecine Clinique faites avec l'aide de la Méthode Graphique et des Appareils Enregistreurs. Le pouls, ses variations et ses formes diverses dans les maladies*. Paris, J B Baillière et Fils, 1870.
[10] Waller, A D, *Journal of Physiology*, 1887, **8**, 229.
[11] Wood, E H, *Circulation*, 1977, **56**, 506.

Exotic diets and the infant

In recent years better understanding of brain growth and maturation in early life has led to concern about the possible long-term effects of nutritional deprivation in young children.[1] Even in the industrialised countries suboptimal nutrition may occur in utero (in small-for-dates babies), and we are still uncertain about which food best satisfies the nutritional requirements of premature babies.[2] These considerations apart, however, there are two further circumstances in Britain and the United States in which young children's diets may be nutritionally inadequate. The first of these concerns the Asian immigrant community in the United Kingdom,[3] and the second arises from the increasing popularity of restrictive cult diets in the United States.[4 5]

In clinical practice there are four main nutritional problems seen in Asian immigrant children. These are iron deficiency, rickets, poor weight gain (especially between the ages of 6 months and 2 years), and deficiencies of folate and vitamin B_{12}. The last of these, though less common, tend to be the most alarming, since the children frequently present with very low haemoglobin values of about 3 or 4 g/dl.

Unfortunately breast-feeding has become uncommon in the Asian community in Britain. The type of dietary restriction in these families is largely governed by religious belief: Hindus tend to be lactovegetarian, while Moslems have dietary customs similar to those of orthodox Jews, eating no pork, and other meats only after ritual slaughter (halal meat is the Muslim equivalent of Jewish kosher meat).[3] Commercially available baby dinners containing meat are therefore not acceptable to either of these two communities, and babies tend to be weaned from the bottle late and on to mainly starchy, low-protein foods such as soups, puddings, and egg custard. Muslim parents should be encouraged to introduce halal meats finely ground into the diets of their children soon after weaning at about 4 months. In view of the size of this community manufacturers might find it commercially feasible to provide junior dinners containing such meat. Vegetarians' diets should ideally contain a mixture of proteins derived from both legumes (about 20% protein, low in methionine, adequate lysine) and cereal grains (about 10% protein, low in lysine, adequate methionine). Drinking milk and eating milk products and eggs should be encouraged in those less strict vegetarians who will eat them. In a strict vegetarian diet iron and calcium may be provided from legumes, green leafy vegetables, grains, and some nuts. Vitamins D and B_{12} should be provided as supplements or in fortified vegetable foods.

In the USA there has recently been a growth in the number of young adults who eat cult diets. Among these are vegans, members of various yogic sects, adherents of the yin and yang philosophy, Seventh-Day Adventists, and those who keep to the zen macrobiotic diet. Of these, the Seventh-Day Adventists, being lacto-ovo-vegetarian, are the least restricted and their diet is usually adequate. The vegan diet is a strict vegetarian diet and therefore likely to be deficient in vitamins D and B_{12}. The most dangerous of these diets, however, is the zen macrobiotic diet.[5] Its adherents progress through ten stages of increasing dietary restriction until they are taking only cereals. Severe nutritional deficiencies may result. A zen macrobiotic infant food called kokoh has been associated with severe malnutrition in infants.[6] In a recent study of the growth of preschool children from vegetarian families in Boston[7] nearly all vegetarian mothers were found to have breast-fed their babies, but they tended to wean late. This late and inadequate weaning was thought to be the cause of the slow growth in these vegetarian children in their first two years. After the age of 2 there was some catch-up, with the vegetarian children tending to have slightly increased growth rates compared with normal.

Hippocrates believed that medicine "was founded for the health, preservation, and nourishment of man, and to rid him of that diet which caused pain, sickness, and death."[8] Doctors need still to be aware of their patients' nutritional inadequacies and to provide sound dietary advice. In most instances such advice can be compatible with a respect for the patients' own customs and beliefs, but when those beliefs cannot be squared with adequate nutrition it is the doctor's duty to say so—and this duty becomes the more compelling when the development of young children is at risk.

[1] Dobbing, J, in *Scientific Foundations of Paediatrics*, ed J A Davis and J Dobbing, chapter 32. London, Heinemann, 1974.