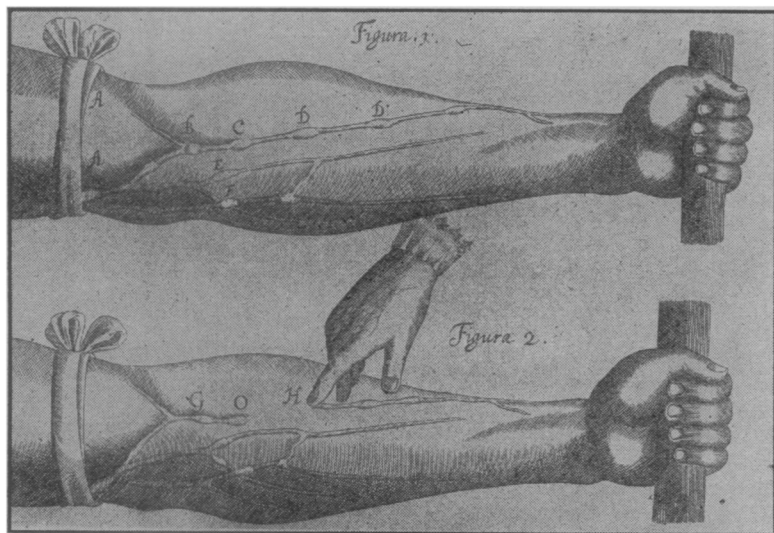


Classics of Science: Circular Movement of the Blood



HARVEY'S OWN ILLUSTRATION OF HIS EXPERIMENT which he described as follows: Let an arm be tied up above the elbow as if for phlebotomy (A, A, fig. 1). At intervals in the course of the veins, especially in labouring people and those whose veins are large, certain knots or elevations (B, C, D, E, F,) will be perceived, and this not only at the places where a branch is received (E, F), but also where none enters (C, D): these knots or risings are all formed by valves, which thus show themselves externally. . . . Apply the thumb or finger over a vein in the situation of one of the valves in such a way as to compress, and prevent any blood from passing upwards from the hand; then, with a finger of the other, streak the blood in the vein upwards till it has passed the next valve above, the vessel now remains empty; the finger being removed for an instant, the vein is immediately filled from below; apply the finger again and having in the same manner streaked the blood upwards, again remove the finger below, and again the vessel becomes distended as before; and this repeat, say a thousand times, in a short space of time. And now compute the quantity of blood which you have thus pressed up beyond the valve, and then multiplying the assumed quantity by one thousand, and you will find that so much blood has passed through a certain portion of the vessel; and I do now believe that you will find yourself convinced of the circulation of the blood and its rapid movement.

Dr. William Harvey here describes his reasons for believing that blood is sent out by the beating of the heart through the arteries, thence finding its way to the veins which return it to the heart. Although the microscope was then unknown, Harvey was able to demonstrate his belief by the easily duplicated experiment quoted here. It was not until four years after Harvey's death that Malpighi saw blood circulating in the lung of a frog.

AN ANATOMICAL DISSERTATION UPON THE MOVEMENT OF THE HEART AND BLOOD IN ANIMALS, BEING A STATEMENT OF THE DISCOVERY OF THE CIRCULATION OF THE BLOOD, by William Harvey, Franckfort-on-the-Maine, 1628.

Quantity of Blood

Thus far I have spoken of the passage of the blood from the veins into the arteries, and of the manner in which it is transmitted and distributed by the action of the heart; points to which some, moved either by the authority of Galen or Columbus, or the reasonings of others, will give their adhesion. But what remains to be said upon the quantity

and source of the blood which thus passes, is of a character so novel and unheard-of that I not only fear injury to myself from the envy of a few, but I tremble lest I have mankind at large for my enemies, so much doth wont and custom become a second nature. Doctrine once sown strikes deeply its root, and respect for antiquity influences all men. Still the die is cast, and my trust is in my love of truth, and the candour of cultivated minds. And sooth to say, when I surveyed my mass of evidence, whether derived from vivisections, and my various reflections on them, or from the study of the ventricles of the heart and the vessels that enter into and issue from them, the symmetry and size of these conduits,—for Nature doing nothing in vain, would never have given them so large a relative size without a purpose,—or from observing the arrangement and intimate structure of the valves in particular and of the other parts of the heart in general,

with many things besides, I frequently and seriously bethought me and long revolved in my mind, what might be the quantity of blood which was transmitted, in how short a time its passage might be offered, and the like. But not finding it possible that this could be supplied by the juices of the ingested aliment without the veins on the one hand becoming drained, and the arteries on the other getting ruptured through the excessive charge of blood, unless the blood should somehow find its way from the arteries into the veins, and so return to the right side of the heart; I began to think whether there might be a movement, as it were, in a circle. Now this I afterwards found to be true; and I finally saw that the blood, forced by the action of the left ventricle into the arteries, was distributed to the body at large, and its several parts, in the same manner as it is sent through the lungs, impelled by the right ventricle into the pulmonary artery, and that it then passed through the veins and along the vena cava, and so round to the left ventricle in the manner already indicated. This movement we may be allowed to call cir-

(Just turn the page)

ARCHÆOLOGY

Irish Relics Not Genuine

The chipped stones from the sea-coast of Sligo, Ireland, which were recently described by the British archæologist J. P. T. Burchell as implements made by early Stone Age men, have become the subject of scientific controversy. A committee of Dublin investigators, R. A. S. Macalister, J. Kaye Charlesworth, R. Lloyd Praeger and A. W. Stelfox, have reported to Nature that they have investigated the caves on the Irish coast, and find that they are apparently of a much later date, geologically, than the Old Stone Age. They declare further that the chipped stones in question are of limestone, a most unsuitable material for implements, and that they can not find any evidence that the chipping is the result of anything but accidental fracture.

Science News-Letter, November 26, 1927

ORTHOEPEY

Accents Wild

On my shaky grammatical perch
I am made, very often, to lurch,
By some otherwise quite
Sane and sensible wight
Who says *re-search*, instead of
re-search.

Science News-Letter, November 26, 1927

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Circulation of the Blood

(Continued from page 341)

cular. in the same as *Aristotle* says that the air and the rain emulate the circular movement of the superior bodies; for the moist earth, warmed by the sun, evaporates; the vapours drawn upwards are condensed, and descending in the form of rain, moisten the earth again. By this arrangement are generations of living things produced; and in like manner are tempests and meteors engendered by the circular movement, and by the approach and recession of the sun. . .

Circulation Confirmed

But lest anyone should say that we give them words only, and make mere specious assertions without any foundation, and desire to innovate without sufficient cause, three points present themselves for confirmation, which being stated, I conceived that the truth I contend for will follow necessarily, and appear as a thing obvious to all. First,—the blood is incessantly transmitted by the action of the heart from the vena cava to the arteries in such quantity that it cannot be supplied from the ingesta, and in such a manner that the whole must very quickly pass through the organ; Second,—the blood under the influence of the arterial pulse enters and is impelled in a continuous, equable, and incessant stream through every part and member of the body, in much larger quantity than were sufficient for nutrition, or than the whole mass of fluids could supply; Third,—the veins in like manner return this blood incessantly to the heart from parts and members of the body. These points proved, I conceive it will be manifest that the blood circulates, revolves, propelled and then returning, from the heart to the extremities, from the extremities to the heart, and thus that it performs a kind of circular movement.

Let us assume either arbitrarily or from experiment, the quantity of blood which the left ventricle of the heart will contain when distended, to be, say two ounces, three ounces, or one ounce and a half—in the dead body I have found it to hold upwards of two ounces. Let us assume further, how much less the heart will hold in the contracted than in the dilated state; and how much blood it will project into the aorta upon contraction;—and all the world allows that with the systole something is always projected, a necessary consequence demonstrated in the third chapter, and obvious from the struc-

ture of the valves; and let us suppose as approaching the truth that the fourth, or fifth, or sixth, or even but the eighth part of its charge is thrown into the artery at each contraction; this would give either half an ounce, or three drachms, or one drachm of blood as propelled by the heart at each pulse into the aorta; which quantity, by reason of the valves at the root of the vessel, can by no means return into the ventricle. Now in the course of half an hour, the heart will have made more than one thousand beats, in some as many as two, three, and even four thousand. Multiplying the number of drachms propelled by the number of pulses, we shall have either one thousand half ounces, or one thousand times three drachms, or a like proportioned quantity of blood, according to the amount which we assume as propelled with each stroke of the heart, sent from this organ into the artery; a larger quantity in every case than is contained in the whole body; In the same way, in the sheep or dog, say that but a single scruple of blood passes with each stroke of the heart, in one half hour we should have one thousand scruples, or about three pounds and a half of blood injected into the aorta; but the body of neither animal contains above four pounds of blood, a fact which I have myself ascertained in the case of the sheep.

Upon this supposition, therefore, assumed merely as a ground for reasoning, we see the whole mass of blood passing through the heart, from the veins to the arteries, and in like manner through the lungs.

But let it be said that this does not take place in half an hour, but in an hour, or even in a day; any way it still manifests that more blood passes through the heart in consequence of its action, than can either be supplied by the whole of the ingesta, or than can be contained in the veins at the same moment.

William Harvey was born April 1, 1578, at Folkestone, England, and died June 3, 1657, at the home of one of his brothers in Roehampton. He received the B. A. degree from Cambridge University at the age of nineteen, and went to Padua to study medicine. Taking his degree as Doctor of Medicine at 24, he established himself in London, where he was very successful. He became a fellow of the Royal College of Physicians in 1609, and in 1616 began a course of lectures in which his views on the circulation of the blood were explained. The novelty of these views caused much discussion and comment, but they were not rejected by the medical profession, as proponents of weird medical theories of our day would have us believe.

Science News-Letter, November 26, 1927