

BRITISH MEDICAL JOURNAL

LONDON

SATURDAY APRIL 12 1952

LEONARDO DA VINCI

April 15 is the fifth centenary of the birth of one of the most remarkable beings that has ever lived. For such was indeed Leonardo da Vinci, who first saw the light in 1452. He was the illegitimate son of a peasant girl, and from his childhood showed extraordinary intelligence, beauty, and vigour. His father, member of a well-to-do Florentine legal family, later married a woman of his own class, but Leonardo was early accepted as one of his father's household. Nevertheless his education was certainly defective, since he had acquired no Latin—a very serious handicap in that time when it was the only medium of learning. This lack may well have been a consequence of his own waywardness, but it does correspond to the one weapon missing from his intellectual armoury. For, even if we allow for any educational gap, it is a fact that in his notebooks, five thousand pages of which survive, his literary standard is surprisingly low, especially in contrast with his superb command of the pencil. It is evident that his very active mental life was overwhelmingly visual. His immense and varied intellectual powers could express themselves freely only by graphic methods.

For some years and from about the age of 14 he worked in the studio of that versatile artist Verrocchio, who himself dissected the superficial muscles of the human body. In 1472 Leonardo was brought into contact with a varied society by being admitted to the Company or Guild of Painters of Florence. The guilds in that city had an extremely elaborate organization, and the painters were united, in a complex way, with the dealers in spices, with the physicians, and with the apothecaries. All these were connected with the service of the hospital of Santa Maria Nuova, where Leonardo's first dissections were performed. Among his numerous and immense activities medical men will naturally be most interested in his physiological and anatomical researches. The surviving records of these are nearly all contained in manuscripts in the Royal Library at Windsor Castle. They have been reproduced in eight superb folio volumes of facsimile, many of the best pages of which are now displayed in the East Gallery of the Royal Academy. These exhibits include, however, an original drawing, specially lent by Her Majesty the

Queen, representing a child in its mother's womb. It is a picture of most moving beauty in which the child seems to be dreaming the thoughts of the race that is to come. Despite certain errors of detail, notably in the whimsical division of the placenta into cotyledons, it is perhaps the most beautiful anatomical figure of all time.

Leonardo's anatomical researches may have begun about 1472. By 1489 he was planning a work on the subject which many of these drawings were doubtless intended to illustrate. Alas, it never appeared, though he continued his anatomical researches at least until 1513. Nor was his interest only in the structure of the body. Being a child of his age, he could not fail to be influenced by the universally accepted and highly ingenious physiological system of Galen, but he made many experiments to test its accuracy. Notably some of his results raised the problem of the mechanism of the heart-beat and, in certain important respects, anticipated Harvey. It is not too much to say that had Leonardo's anatomical work been published the discovery of the circulation would probably have been made in the sixteenth century instead of being deferred till the seventeenth, for there were several experimenters at work on the subject between Leonardo and Harvey, not least of them being Vesalius, who came almost exactly at the mid-point in time between them.

In estimating the anatomical and physiological achievements of Leonardo we must not forget that they formed only a fraction of his scientific activities, which in turn formed no more than a fraction of his total activities. The contents of his notebooks bear witness to the part that science and engineering played in his life. He aimed to publish books on mechanics, on the flight of birds, on the elements of machinery, on perspective, and so on. But with them, as with anatomy, the urge to ever fresh investigation interfered with their expression. The interpretation of his manuscripts was moreover long delayed because of his use of mirror writing, apparently adopted as a sort of cipher but relatively easy for him to write, since he was left-handed.

Leonardo dissected more than thirty human bodies. He was busy on this task both at Florence and Milan. Though he was far from being the first of his age to study the structure of the human body, he was certainly the first in modern times to do so on scientific lines. Before him dissections, both "academic" and "artistic," had long been practised. Academic dissections were literally demonstrations. The academic official, literally a "reader," declaimed the authorized text while his demonstrator pointed out, as his title implies, the organ described. All this was done in

public and had to be hurriedly completed in daily sessions on four consecutive days. The students had no direct contact with the part. Leonardo had read the current text for this ceremony, an Italian translation of which was available. On the other hand several earlier artists and some of his own time, including his own master, Verrocchio, anxious to represent the human body correctly, did indeed examine the bones and the surface muscles of flayed corpses. Many of the great works of art of the Renaissance betray the anatomical knowledge thus acquired. But Leonardo went far beyond either the academic or the artist anatomists. He studied the body throughout and in detail. He sought to understand its intrinsic structure by observation and experiment, both prolonged and systematic. His marvellous facility first in visualizing and then in drawing enabled him to superimpose the various structures and tissues on each other in the three dimensions of space. Thus for the first time in history he was able to prepare figures, drawn in true scientific perspective, showing the relations of the parts to each other. In this sense he was the very first anatomist, for even the greatest of the ancients had no such visual aid.

Unfortunately Leonardo never finished anything, and least of all his great anatomical researches. He had not that power of limiting objective which is essential to the strategy of science. His mind so teemed with ideas and with newly observed facts, gathered by his vast industry, that the very channels of expression were blocked. His great discoveries remained *almost* unknown till the nineteenth century.

Almost but not quite. One whose personality aroused so much curiosity, who gave so much time to recondite and unusual studies, could not dissect over thirty bodies without some information about his activities becoming widely known. Neither Florence, nor Milan, where many of his researches were made, were then seats of universities, though they were certainly well-developed seats of gossip. In any event Leonardo would have been the last to make impact on the rigid structure of an academic society. But Leonardo's methods were naturally still known and still spoken of in the studios when 13 years after his death the anatomist Vesalius came to Italy. There he met a fellow-countryman, an artist, who was imbued with the tradition of Italian painting which still looked back to Leonardo. The two men between them seemed to reconstitute one aspect of the spirit of their mighty predecessor. Thus scientific academic anatomy was born with a backward glance at its real father.

The Exhibition at the Royal Academy to celebrate the quincentenary of Leonardo's birth was proposed by the Science Museum. This union of Art and

Science is peculiarly appropriate to the man that it commemorates. Most of the original works are from the Royal collection, though two of the finest are the property of the Academy itself. The anatomical section has been arranged by Dr. K. D. Keele, whose book on Leonardo is reviewed in this issue by Sir Arthur Keith. In connexion with the exhibition a series of lantern lectures is being given in the Senate House of the University of London. Of these, a specific medical interest is attached to those by Dr. K. D. Keele on "Leonardo's Researches on the Heart and the Blood" on April 24, and that of Professor Charles Singer, who closes the series with his "Leonardo and the Structure and Action of the Human Body" on May 29.

Leonardo puts himself in his historical position in words which, with but slight paraphrase, may be read as prophecy.

"You who would despise my drawings as teaching anatomy and say that it is better to look at dissections than drawings, would be right were it possible to see all the details in your dissections. But you will not see more than a few structures, whereas I have dissected many entire human bodies, down to the very smallest particles of flesh. For it was necessary to proceed by stages with as many bodies as would make my knowledge complete. Can you do likewise? For if you be interested in the subject you may be deterred by repugnance. If this do not restrain you, maybe you fear to pass many night hours, as I have done, in the company of corpses, flayed and hideous to look upon. If this deter you not, perhaps you lack the skill in drawing, essential for such work. And even if you have this skill, you may lack knowledge of the laws of perspective, or of the mechanical laws to estimate the action of muscles in movement. Or again, and above all, you may lack patience. As to whether these things have been found in me, the books that I have written will give their answer, Yea or Nay. For in all these I have been hindered neither by avarice, nor by sloth, nor by fear, but only and always by time. Farewell."

The answer will be given to any who will visit the wonderful exhibition at Burlington House and attend the course of lectures on the man and his works at the University of London.

FATIGUE

The Ergonomics Research Society has as its objects the promotion and application of knowledge about man and his working environment, including the design and use of equipment with which a man works and the conditions in which he works. The Society recently organized a symposium¹ on "Fatigue"

¹ The *Proceedings* of the Symposium will be published eventually by the Ergonomics Research Society.