"Literature of Europe," referring to Leonardo, says the discoveries which made the names of Galileo, Kepler, Castelli and others famous, the system of Copernicus, the very theories of recent geologists, were anticipated by da Vinci within the compass of a few pages, not perhaps in the most precise language, or in the most conclusive reasoning, but so as to strike in with something like the awe of preternatural knowledge.

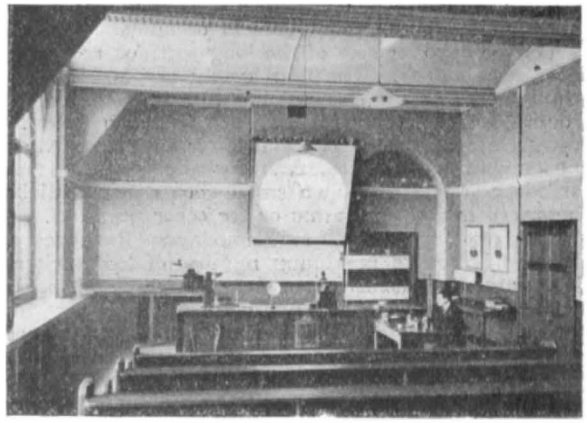
Leonardo da Vinci in his writings deals with and explains the formation of rain drops, the capillary action of liquids, the equal pressure of water in closed vessels, anticipating the application of this principle as carried out nearly three centuries later by Bramah in his hydraulic press. The theory of the motion of waves in water is fully dealt with. The illustration he gives of a field of corn under the influence of the wind when a wave motion traverses the field without the stalks moving, to show the action of the water in similar circumstances, has been often used since, and was adopted by Scott Russell in his report to the British Association on waves in 1836.

Leonardo da Vinci appears to have devoted much attention to the use of mechanical appliances for saving labour in the excavation and removal of earth in the various canals that he was engaged in constructing. He was the first engineer to adopt the use of weirs and locks for overcoming the varying levels of the country through which his canals were carried. A sketch of a pair of lock-gates (Fig. 1), as used on the canal from Ticino to Milan, called the "Naviglio Grande," as given in his "Codice Atlantico," is here reproduced. Gates of almost similar design may still be seen on many of the older canals of this country, where locks were not made use of until 1566. As specimens of the sketches of mechanical contrivances given in his treatise, the illustration of machinery for raising heavy weights (Fig. 2) bears a strong resemblance to appliances to be found amongst contractors' plant of the present day.

The theories set out by Leonardo da Vinci, and his laws for regulating the flow of water in open channels as derived from his own practice and observation, for ascertaining the velocity of discharge due to the balance of forces established between gravity and friction, as to the effect of the junction of two waterways, and the velocity of movement of water as affected by the form of the channel and the depth of the water, anticipated by fully a century the works of Gugliemini, of Paul Frisi and Castelli, to whom, generally, has been given the credit of first determining the problems of hydrology.

THE PHYSIOLOGICAL LABORATORY OF THE UNIVERSITY OF LONDON.

IT was the fear of some of those most interested in the renaissance of the University of London that the good effects of the transfer from Burlington House to the Imperial Institute would not become apparent until many years had elapsed. As scientific research is more and more taking its proper place as the highest duty that a university can perform, it is very gratifying to learn that the University of London has seized a favourable opportunity, and utilised its enlarged premises to this end. Even though this laudable endeavour must be at present regarded in the light of a preliminary experiment not yet included in any authorised programme, the physiological laboratory tentatively initiated by the University appears to be admirably adapted for the purposes to which it is applied, namely, for lectures on advanced physiology and for physiological research. But its chief value is as a concrete object-lesson of what the well-wishers of education in this country desire to see promoted by the University of London, and we are inclined to add, with bated breath, fed from the national exchequer. A municipal body may be expected to realise the importance of technical science, and to pay for its establishment. But it requires outlook towards a wider horizon to realise that apparently useless knowledge is in reality knowledge of which the reward is to be received by future generations.



[FIG. 1.—Room No. 17 (The Lecture Room).

The habitation of this infant laboratory at present comprises the top floor of one side of the main building. A long corridor extends throughout its whole length, and the various rooms open from this right and left. The first, counting from the entrance, is the workshop, where a 1 h.p. dynamo provides power for the various tools used in constructing the smaller apparatus required from time to time. Next is the lecture theatre, with seats for eighty students. Arranged for lectures in advanced physiology, this accommodation has so far proved sufficient; the average attendance has been about thirty, and as no attempt has been made to give merely popular demonstrations, and as only students are invited who already possess some knowledge of the subject, these numbers are very

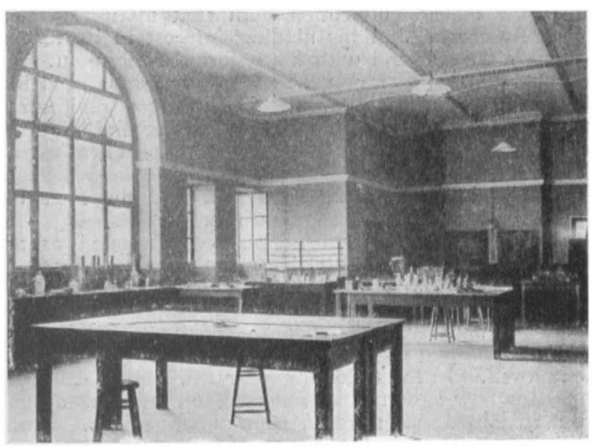


FIG. 2.—Room No. 19 (General Laboratory).

encouraging. The rooms devoted to research are five in number. That next the lecture theatre, with furnaces and a fume chamber, is the chemical room, and contains in addition the apparatus used by the British Medical Chloroform Committee in its determinations. No. 19, with two dark rooms attached, is the general laboratory. This is the largest room on the landing; the centre is used for general purposes and the far end is half-shaded, and serves for galvanometers with the attendant apparatus. Two complete tables are furnished, one with a dark room for photography, and both are at present occupied.

On the opposite side of the long corridor are rooms 20A, 20B, and 21. The two former are fitted up for experiments on the circulation. No. 21 is the private room of the lecturer in charge; it is also used for research in experimental psychology; another galvanometer with resistances, &c., for the lecturer's use stands at one side. Two small rooms are available here, either as dark rooms or for other purposes.

The total laboratory accommodation for research is arranged for a maximum number of ten workers, it being considered that this was what might be reasonably expected, as quality is infinitely more important in work of this kind than quantity. The present workers are seven in number.

Several papers communicated to the Royal Society and other learned bodies testify to the activity of the place, and we shall expect, with some curiosity, a report on its first year of work. The University authorised the occupation of the laboratory in February last, and there does not appear to have been much time lost in getting to work.

PROF. WILLIAM HARKNESS.

BY the lamented death of Prof. Harkness, America loses one of the most devoted of her scientific workers, and the staff of the Washington Observatory one who has laboured strenuously to bring its reputation to the high level it at present enjoys. It is true that his official connection with that institution has recently ceased, but his abiding interest in its future welfare did not end with his enforced retirement. In the few words of farewell in which he announced his approaching resignation, he still evidenced his interest in the Observatory he had served so long and so faithfully, and in a spirit of true loyalty to practical astronomical science, he indicated the direction in which he considered the equipment deficient and the lines on which further extension should proceed.

In 1862 we first find his name mentioned as an assistant, working with the mural circle and prime vertical instrument at a time when Prof. Hubbard, whose name recalls another and a different sphere of scientific activity, had the control of those instruments, and determined the direction in which they should be employed. In the following year Prof. Hubbard died, and the new assistant was elected to the professoriate, but remained in charge of the same apparatus. From this time onward, the history of Prof. Harkness is written in the *Annals* of the Observatory, and in its activity and its development he found ample occupation, as in its increasing reputation and influence he found his reward. There is no need to go over in detail the various works in which he was engaged, whether as an accurate or painstaking observer, or as one singularly capable in the management and arrangement of large pieces of laborious, and perhaps uninteresting, work. Let his work on the reduction of the observations of Gilliss' zones, or his perhaps unthankful task in reducing the observations of the transits of Venus in 1874 and 1882 speak for his patience and energy. Just as little need we refer to his various determinations of differences of longitude, or of his participation in the observations of solar eclipses and their subsequent discussion; it is sufficient to say that no astronomical inquiry, that occasionally in the course of long years falls to the lot of an observatory assistant of the highest class, passed without his contribution to its success, or his suggestion for its improvement. Finally, we find him occupying the position of astronomical director of the Observatory and superintendent of the Nautical Almanac, a twofold task which must have taxed his activity, but it cannot be said that he was found wanting in either capacity.

Perhaps he will be best remembered, as he is best known, by his work on the "Solar Parallax and its Related Constants," though we should doubt if he would consider it as his best contribution to astronomical inquiry. In it he undertook the difficult, perhaps impossible, task, to assign a relative degree of accuracy to observations differing in character, in principle and in design, and to deduce from the multifarious evidence a precise value of the solar parallax, in which each of the different processes contributes its just share to the final result. But the extent and completeness of the inquiry constitute it a valuable historical record. His theoretical writings and his mechanical ethos each call for a word of remark. As evidence of the former, we may refer to his paper on the "Colour Correction of Achromatic Telescopes," and of the latter to the share he took in the transfer of the old observatory to its new site, to his remodelling of instruments, and, in particular, to his invention of the spherometer-calliper, which, we believe, was used with success in the testing of the instruments employed in the transit of Venus expeditions. In him astronomy loses one who has spent himself without stint in her service, and his colleagues, to whom we offer our respectful sympathy, a sincere friend and an able director.

W. E. P.

NOTES.

THE council of the British Association has unanimously nominated the Right Hon. Arthur James Balfour, F.R.S., to the office of president for the Cambridge meeting in 1904. It has also been agreed to recommend to the Association the acceptance of the invitation to South Africa for the year 1905.

MAJOR P. A. MACMAHON, F.R.S., has been elected a member of the Athenæum Club under the rule which empowers the annual election by the committee of nine persons "of distinguished eminence in science, literature, the arts, or for public services."

THE death is announced of M. Gaston Paris, distinguished by his critical contributions to philological science. M. Gaston Paris was a member of the French Academy, and head of the College de France.

THE death is announced of Dr. Hénocque, assistant director of the laboratory of biological physics in the College de France.

THE officers elected by the French Physical Society for the current year are as follows:—Vice-president, Prof. D'Arsonval; secretary, M. H. Abraham; vice-secretary, Prof. Jules Lemoine; treasurer, M. de la Touanne. The president (M. H. Poincaré) announces that the Society has received an anonymous donation of 2000 francs.

A NEW series of the *Journal des Savants* commences with the present year. It will in future be under the control of