above: there is a science of experimental medicine. The work of Sir Thomas Lewis and his collaborators on the heart and vascular system, its disorders and their treatment, has constituted the central stream of progress made in these subjects during the past decade. For similar advances in other directions it is essential to recruit clinical research workers, but men will not be attracted without the possibility of some definite post in clinical research being available to them in the future, which is not the case at present. The Council therefore proposes to increase the number of clinical workers upon its permanent staff as soon as suitably-trained candidates who have shown their aptitude for this type of research are available. Meanwhile, the Council is prepared to encourage young workers to test themselves in this branch of medical research with the view of its becoming their life-work.

The vascular response of the skin to injury has been further investigated during the year. The vessels in the frog's tongue react to injury in the same way as those of the human skin, but do not respond to histamine. A substance, probably a base of the histidine-arginine series can, however, be extracted from frog's skin which will reproduce the vascular reactions of injury not only in the frog's tongue, but also in the human skin (Grant and Jones). This result confirms the previous conclusion that the reaction to injury consists essentially in the liberation from the cells of the skin of histamine or some similar substance. Similarly, the demonstration that acetylcholine can be isolated from the spleen is evidence in favour of its actual liberation in the tissues following certain kinds of nervous action, when the results of such nervous stimulus can be duplicated by the injection of acetylcholine (Dale and Dudley).

In this review it is impossible to refer to more than one or two of the other researches which have been carried out by members of the scientific staff of the Council or by independent workers helped by grants-in-aid: abstracts of these researches, together with references to published papers, are given in the report. Work on virus diseases has been continued: the difficulty of making rapid progress is due to the fact that they cannot yet be grown on artificial media, although some will grow *in vitro* in the presence of a piece of surviving tissue. The present position with regard to viruses is rather like that facing bacteriologists fifty years ago before adequate methods of microscopic study and cultivation had been worked out. More progress has been made in the devising of methods of immunising animals to these diseases, and it is now possible to immunise dogs to distemper, fowls to fowl plague, and monkeys to yellow fever.

Research on chemotherapeutic agents is being actively pursued: certain aromatic amides containing arsenic have a pronounced curative action in some types of trypanosomiasis, as well as some new styryl compounds: the latter are being tested against trypanosomiasis of cattle in Tanganyika Territory.

Finally, among other subjects referred to in the report may be mentioned work on cancer and radium, anæsthetics, the vitamins, and the physiological actions of different types of light.

The Deutsches Museum, Munich.

THE Royal Commission on National Museums and Galleries in its Final Report, of which, as a whole, we had something to say in our issue of Feb. 1 (p. 153), deals with individual institutions. We are particularly interested in those which are wholly or partly of a scientific character, and we notice that the Commissioners in dealing with the Science Museum direct pointed attention to the Deutsches Museum von Meisterwerken der Naturwissenschaft und Technik, to give it its full title, "not only because it is in itself a remarkable example of how a modern Museum can be made a great instrument of technical as well as of popular instruction, but because it is a symbol of national efficiency. It reveals the intense concentration in the Germany of to-day on the scientific means of industrial progress, a concentration which we believe has its sharp significance for this country." We are pleased, by the way, to see that the Commissioners commend to the nation the scientific attitude of mind, for it is one that we try year in and year out in these columns to inculcate.

Perhaps, then, we can scarcely do greater service to our readers than to place before them a brief account of the Deutsches Museum. Its aim is stated succinctly and correctly in the words of the Report: to illustrate "the development of research and discovery of every age and of all countries, an Institution in which the results of scientific research and experiment should be fully shown. . . . But beyond this another purpose has been kept in view. The Museum is to be a great instrument for the education of the visitor. He must not only be informed by studying the exhibits as to the growth and progress of a subject, but as far as possible he must be put into a position to realize and verify, through experiments performed by himself, the steps by which the progress has been achieved." Such is the example held up to us for emulation.

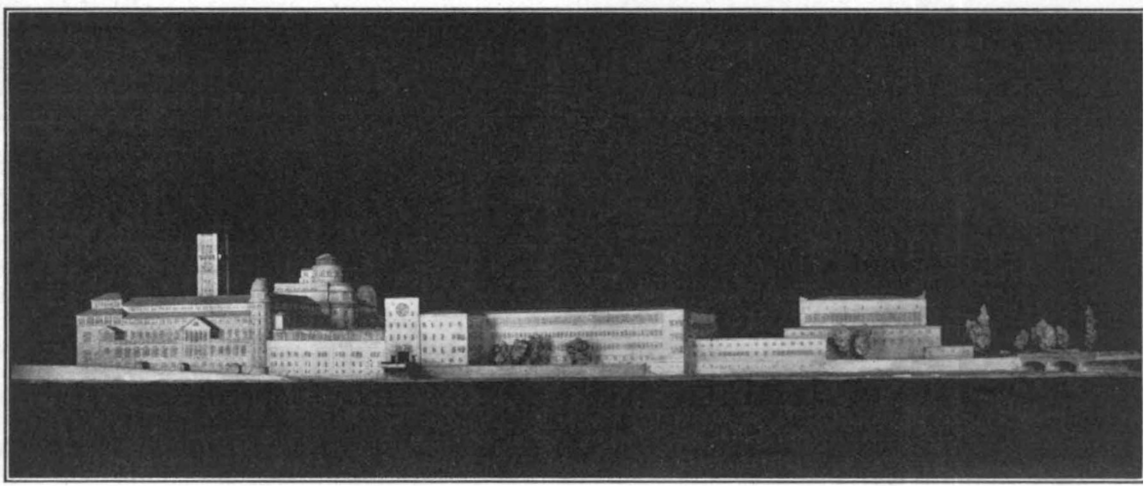
A short account of the Museum was published in Nature in 1925 (Vol. 115, 611), when the Museum was about to be formally opened, and it is unnecessary, therefore, to repeat the history beyond saying that the institution, contrary to what one might expect in Germany, is neither State owned nor State governed. It owes its inception and management up to the present to Dr. Ing. Oskar von Miller, a distinguished electrical power engineer, and it is an open secret that the idea of forming a museum of this kind was implanted in his mind when, as a young man, he visited the Loan Collection of Scientific Apparatus at South Kensington in 1876. He pondered the idea for more than a quarter of a century until he felt able to put his plans before the technical and scientific public of Germany. The scheme was approved unanimously and work was at once commenced in temporary premises. The permanent building, of a model of which, prepared last year, we give an illustration (Fig. 1) kindly supplied by Dr. von Miller, together with a ground plan (Fig. 2), from the same source, is magnificently situated on an island in the River Isar, on which the city of Munich stands. The Museum was opened with almost princely splendour on May 7, 1925, the seventieth birthday of the founder and director.

The building is rectangular in plan, 345 feet by 325 feet, and the whole of the area on the ground floor is given up to exhibition space, side and top lighted. The basement, of the same extent, is taken up partly by exhibits, partly with workshops and the necessary museum services. A sub-basement is used to set out coal, mineral, and salt mines. On the first floor the building is brought to the form of a hollow rectangle with a median gallery, which in common with the two galleries parallel to it are 68 ft. wide; the galleries at the ends are 57 ft. wide. The second, third, and fourth floors are repetitions of the first without the median gallery. At the south-west angle is a noble tower used for a barometer and lift. At the north-east angle a fifth and a sixth floor have been built for astronomy. In all there is a grand total of 387,000 sq. ft. of public floor space. Both electric heating and lighting are supplied free by the city of Munich from a transformer station fed from the great Walchensee grid supply, in the origination of which von Miller himself was largely concerned.

The way in which the building was carried out, mainly in the post-War period of financial instability, reads like a romance. The aggregate for the reinforced concrete came from the bed of the river; the cement, stone, wood, and steel were given, the professional men received no fees, and the workmen even worked on Sundays for nothing. The result is a building estimated to have cost $1\frac{1}{2}$ million pounds.

The Museum galleries are subdivided by partitions into spaces each sufficient for the section concerned, which is thus marked off from the rest, at the same time affording space for wall cases or diagrams. In museum fittings there is no rigidity; everything seems designed to suit the particular circumstances.

On the first floor over the entrance is a Hall of Fame, where memorials to the great men of science are set up. This human touch is everywhere, for lesser men are commemorated in the sections where their labours are recorded. On the second floor is a reading room with a supply of technical literature and there are four bookstalls. There are also two refreshment rooms.



Museum Building, 387,504 sq. ft. exhibition floor space.

Connecting building with restaurant.

Library Building, with bookcases, reading rooms, and stacks for one million volumes.

Connecting building with two lecture halls for 200-300 persons.

Congress Hall building with accommodation for 2000 persons.

FIG. 1.—THE DEUTSCHES MUSEUM, MUNICH.

'Interiors' affording a further human touch are a great feature. These take a variety of forms; for example, a scythe forge of 1803 from the Black Forest; a copy of a Swiss watchmaker's shop with its hand tools, side by side with a portion of a modern factory with machine tools, for comparison; an actual paper mill of the eighteenth century; reproductions of an alchemist's and of an eighteenth century chemist's laboratory; a scriptorium with a monk copying a missal; a fine salon containing the old musical instruments, with a musician in attendance to play upon them.

Interiors of a different order are the two planetaria in the Astronomy Section. We need mention only the Ptolemaic one; by an optical projection apparatus images of the fixed stars of the northern hemisphere are thrown on the domed ceiling of a darkened room and the motion of the heavens during twenty-four hours can be reproduced in the space of four minutes. Further, by another projection apparatus, in conjunction with gearing like an orrery, the images of the sun, moon, and planets can be thrown on the same dome, and their motion during a whole year reproduced in five minutes. The effect is thrilling and created a furore in Germany, with the result that planetaria have been installed by many of the larger cities.

Since the main function of a museum as usually understood is to conserve objects, we find a great feature made of collections of original apparatus and MSS. of famous workers in science. The wealth of material under this head is remarkable when it is considered how loth to part with it must have been the institutions in which it had hitherto been preserved. It is a tribute to von Miller that he has been able to deflect the policy, only too frequently pursued, of the 'dog in the manger'.

Were there nothing further in the Museum than what we have cited above, we should describe it as an advanced institution of its kind, but little more. We find, however, another feature, and the outstanding one, and that is its direct educational purpose. Everywhere, and more particularly in the Physics Section which has been longest in being and is presumably most mature, the visitor finds experiments described in modern text-books so arranged that he can perform them by himself or with the aid in some cases of an obliging attendant. He can demonstrate natural laws and reproduce some of the more striking results of modern physics. The dictum of Goethe has been acted on: " Es ist nicht genug zu wissen, man muss auch thun." For example, in acoustics the gradual development of our knowledge of sound vibrations is brought out by experiment. The formation of the voice, the action of the ear, the phonograph and gramophone are made clear with working models. In a specially designed room are experiments to hand on the composition and resolution of musical notes. In optics, again, for example, defects of vision are shown by four models of an eye viewing illuminated objects at a distance. In each case the retina is transparent, and the visitor sees from behind the images of the objects projected on it. The first eye is normal; by a slight adjustment of the lens in the eye the near or far distant object can be focused. The second eye is short-sighted; the near object is distinct, the far object is brought into focus by interposing a concave lens. The third eye is long-sighted for the near object; a convex lens has to be interposed. The fourth eye is astigmatic and a cylindrical lens is required for correction. Would any person after seeing this exhibit wear spectacles picked up at random?

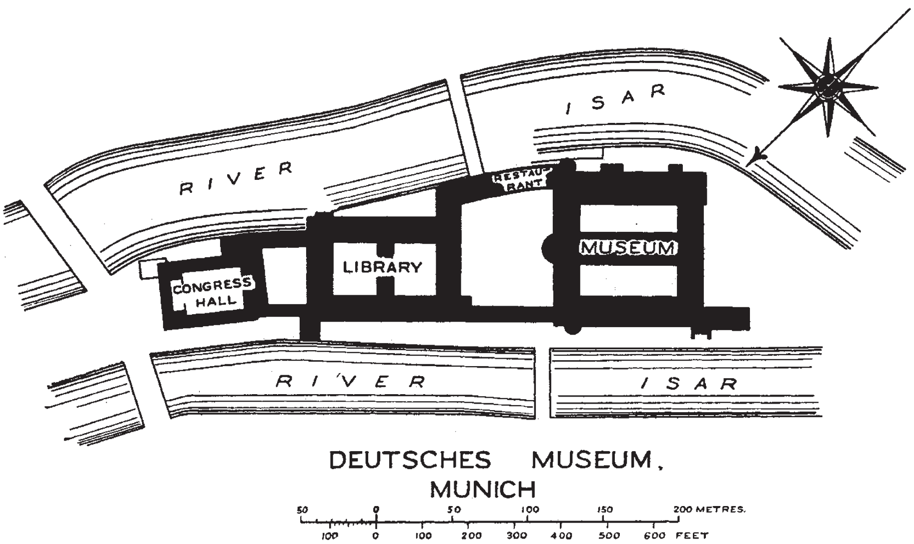


Fig. 2.

In aeronautics is a small working wind channel where, with the aid of an attendant, the lift and resistance of solids can be measured on sensitive direct-reading balances. Selected objects that have the same resistance but are very different in shape, for example, a circular disc and a model of an airship, are tried successively. In section after section one comes across similar experimental apparatus.

There are other activities that we noticed, such as the guide lectures twice daily in the galleries. These are so arranged that practically the whole of the collections are covered in the week. Lantern and film lectures are given in the afternoons.

This, however, is far from completing the story, for von Miller had the further conception of a vast library to contain MSS. and books on science, periodicals, drawings, diagrams, portraits, photographic films, lantern slides and catalogues, in fact to constitute a record office of the march of science, a storehouse of garnered knowledge and of material upon which further research can be made. The Museum really only presents in an assimilable form an epitome of what will be found eventually in the Library. This conception is taking shape rapidly, and the building, adjoining the Museum, yet integral with it architecturally, is being pushed on rapidly so that it may be opened next month. From what has just been said it will be seen that the Library is much greater in extent than the Museum.

Beyond the Library building must be mentioned the Congress Hall with accommodation for 2000 persons. This is provided with arrangements for lantern, silent and sound film projection, as well as for scientific demonstrations.

The building that joins the Museum to the Library has restaurant accommodation, and in the corresponding building between the Library and the Congress Hall are two lecture rooms with accommodation for 200-300 persons, principally intended for schools and institutions.

As one traverses the galleries and muses on the complexities of civilised life and how little the great bulk of our populations realise, much less understand, the nature of the network of social activities upon which their very existence depends, to say nothing of the conveniences and amusements with which they are surrounded, one cannot help thinking that wise statesmen would see to it that museums such as this should be established in every large territory and that visits to it should be part of the duties of citizenship. Judging from our own reaction to the Museum, it fires the imagination, arouses the creative or inventive instinct, deepens the sense of responsibility to one's fellows and leads to a determination to add if possible to the common weal.

What lessons has the Museum to teach us, particularly in regard to developing the Science Museum at South Kensington? Let us remember that it was in Great Britain three-quarters of a century ago that the idea originated that a museum must not be a storehouse merely, but also a direct means of education. Without slavish copying, and bearing in mind the serious limitations imposed by the nature of the present site at South Kensington, we suggest that considerable extension of the experimental apparatus should be made. Further, that the human note should be sounded by paying greater attention to the lives of the great men who have left their mark on this age of ours. The addition of interiors, again giving the human touch by showing man in his environment at different periods, is eminently desirable. A planetarium should be installed even if the necessary large outlay —£20,000—upon it should have to be recouped by a special charge for admission.

It is no use complaining of the attitude of the public towards science; that attitude can be changed for the better if we bring science to the public. The success of the Science Museum, judging by the attendances since the present building was opened, shows that response is immediate.

Obituary.

Prof. J. O. Arnold, F.R.S.

PROF. ARNOLD, whose death occurred on Mar. 27, must be regarded as one of the founders of the modern metallurgy of steel. It was largely through his efforts that the scientific control of manufacture by chemical analysis and microscopical examination has been generally adopted in the steel industry, whilst his researches have played a most important part in building up our knowledge of the constitution of the alloys of iron. In both these directions he rendered great services to science in general, and to the industry of his adopted city of Sheffield in particular.

John Oliver Arnold was born at Peterborough on Dec. 29, 1858, his father being an engineer by profession. He was educated at King Edward VI. School, Birmingham, and entered the navy as a cadet, but quitted it after a voyage to India, becoming a works chemist at a time when few steel works had such men on their staff. His naval experience left him with a strong love of the sea, and he remained an enthusiastic yachtsman to the end of his life, although the restrictions of the War period compelled him to leave the stormy seas of the west coast and to confine his sailing to the waters of Windermere.

In 1889, after eleven years as a works chemist and consultant, Arnold was appointed professor of metallurgy in the Sheffield Technical School, and here he continued to work until his retirement through ill-health in 1920, the Technical School having meanwhile become a part of the University of Sheffield, with a separate Faculty of Metallurgy, of which Arnold was appointed Dean. On his retirement he was nominated emeritus professor. His work during thirty-one years was intimately bound up with the progress of the Department of which he was the head, and its interests always stood first in his activities. He had to create the demand for trained men in the steel industry, and his enthusiasm enabled him to achieve great success in this direction, so that he had the pleasure of seeing his old students occupying leading positions in industry, and themselves carrying out researches in his favourite science.

On the scientific side, Arnold's work followed on that of Sorby, whose friend and disciple he was. He became convinced of the value of Sorby's use of the microscope in the study of steel, and himself did much to perfect the technique of metallography, whilst his discoveries were made by a skilful combination of chemical and microscopical methods. It is remarkable that for many years he made little use of photography in recording the structure of metals, but preferred drawings, many of which were executed with wonderful skill and patience by members of his staff. He was always inclined to prefer a chemical explanation to one which depended on more obscure physical changes, as in his long controversy concerning the causes of the hardness of steel, which he maintained to be due to combination with carbon rather than to the existence of allotropic modifications of iron. The two schools have become reconciled since, but it is impossible to read the earlier papers without realising that Arnold was always close to experience, and that his arguments were invariably based on practical knowledge of the behaviour of steel in the laboratory and in the works. His descriptions of troostite and of what is now called martensite show a remarkable insight, although the terms in which he described the structures often seemed to differ from those in general use. He also added much to our knowledge of the influence of impurities on steel.

Arnold was closely connected with the development of high-speed tool steels, and in this matter he had the closest confidence of the manufacturers. It was due to him that vanadium was adopted as a constituent of the highest class of such steels,