

corroding affection." The "bronze disease," says Dr. Frazer, "produces a remarkable disintegrating effect on the object it attacks, and there are good reasons for considering that it possesses infective powers, spreading like a leprosy through the substance of the metal, and slowly reducing it to amorphous powder; further, there are substantial grounds for believing it capable of being conveyed from surfaces already suffering with it to those yet uninfected. So that dishonest counterfeiters of antiques now propagate it on their modern forgeries to deceive intended purchasers. This infamous act is as yet understood to be confined to Italy, where the greater part of these forgeries are made." "In genuine antiques, it unfortunately happens occasionally that the patinated surface of bronze, soon after its discovery from recent excavations, becomes affected with this distinctive bronze disease, which makes its appearance in a number of small spots of clear pale blue colour, that swell and form farinaceous elevations; in the course of time, especially when kept in a moist atmosphere, these spots enlarge, run together and multiply, gradually invading the greater part of the surface, and reducing the object to a powdery condition."

Dr. Frazer says a remedy is found in ink made from sulphate of iron and oak galls, and that scraping "risks a fresh outbreak of this infectious malady." Further on he says the chief operator in Rome is well known, and "It would appear that those skilful artists of false antiques having succeeded in counterfeiting genuine patinations, so as to deceive the most learned collectors, have subsequently gone to the length of infecting their reproductions with spots of the bronze disease. This is no mere superficial imitation which they cause, but absolute inoculation of the destructive canker itself."

In conclusion, Dr. Frazer refers to an article in the *Revue Archéologique* on the same subject by the late Count Michel Kyskiewicz, under the title, "Notes and Souvenirs of an Old Collector."
W. G. S.

Dunstable.

I AM not aware of any book on the subject, but Mr. Nicholson will find scattered notices in the *Zeitschrift für Hygiene* and *Arch. für Hygiene*, also the *Journals* of the Chemical Society and Society of Chemical Industry, and *British Journal of Photography* (development of bacteria in silver gelatine films).

The best way to sterilise ancient implements is to suspend them in an oven at a temperature of 150° C.-180° C. for two hours, and let them cool in a free current of air in order to prevent deposit of moisture. This method is quite harmless to the metal, and will sterilise the most resisting spores. It presents obvious advantages over the use of antiseptic fluids.

36 Finsbury Pavement, E.C. G. LINDSAY JOHNSON.

Ebbing and Flowing Wells.

I HAVE had occasion to live for many months of several years close to a well that was sometimes affected by the tide like that at Newton Nottage (*NATURE*, May 12, p. 45). This was at Alibag, a few miles south of Bombay. The bed rock is a sheet of basalt of rather uneven surface, sloping westwards at the general rate of about six feet to the nautical mile. Over this, at the spot in question, were low sand-dunes, covered with palm orchards, and full of brick wells. One of my wells was twenty or twenty-five yards from true high-water mark of spring tides, though the surf washed light objects much nearer.

In the dry weather the ebb and flow did not perceptibly affect the well; but during the monsoon the sand-dunes were saturated by the heavy rainfall, and all along their seaward foot, where the sand lay on the sheet-rock, well below high-water mark, the fresh water poured out at ebb tide. When high spring tides were coincident with heavy rain the water in this well rose a little later than the tide, and several feet higher, almost to the level of the ground around the well. Its taste was not affected. At such times the surface in the well was two feet higher than the floor of my house, which stood in a hollow of the dune, a few yards to the eastward. The house was a notorious death-trap (as might be expected); and it was in the course of endeavours to get it condemned and pulled down, that I made the observations related. As it was a Government building, the records are official; and I write from memory. But the well is probably still there; and the observations, in that case, could be verified during any monsoon.

May 13.

W. F. SINCLAIR.

NO. 1490, VOL. 58]

TECHNICAL HIGH SCHOOLS—A COMPARISON.

AT different times attempts have been made to convey to English readers interested in scientific education some idea of the facilities provided abroad, particularly in Germany and Switzerland, for the higher technical instruction. The reports of the Technical Instruction Commissioners, and of other persons who have inspected the principal foreign schools, give full particulars of the courses of study pursued in those schools, of the rapidly increasing number of students in attendance, and of the large professorial staff attached to each institution. Exact details, however, as to the magnitude of the technical high schools of Germany have not been hitherto presented in such a form, as might readily show the full importance which our German neighbours attach to the higher scientific training, as a means of advancing their commercial interests. On my return, in the autumn of 1896, from a short visit to Bavaria and Würtemberg, in company with some of my colleagues of the Technical Instruction Commission, I gave some account, in the pages of this journal, of the new electro-technical and electro-chemical institutions, recently erected in Darmstadt in connection with the polytechnic of that town. A few weeks since, I had occasion to pay a flying visit to Aachen, and there I found close to the old polytechnic, erected in 1870, an entirely new building, opened only in 1897, and devoted almost exclusively to electrical work. This school, although not so large, nor so well equipped, as the schools in Stuttgart and Darmstadt, forms a very important addition to the facilities for the higher technical instruction which previously existed in the Rhenish city. It will be seen from the accompanying illustration (Fig. 1) that this new building is a plain structure of four stories, with no pretensions to architectural effect. It is about 140 feet long, and is of a mean depth of about 90 feet, the total area covered by the building being little less than that of the science schools of South Kensington, and about half of that of the Technical Institute of the City Guilds. Yet this building is devoted almost exclusively to the teaching of one branch of applied physics.

Dr. Bosse, the well-known energetic Minister of Education for Prussia, in his dedicatory address at the opening of this school in May last, correctly expressed German opinion when he said: "Neither the technical sciences nor the technical high schools can be said to have yet reached their goal. Both stand in the midst of a restless and irresistible movement and development pressing ever forwards." This recognition on the part of the Prussian Minister of the necessity of constantly improving educational facilities so that they may keep pace with the advance of science, is characteristic of the progressive policy of Germany.

The progress I found this year in Aachen, and eighteen months ago in Stuttgart and Darmstadt, might be observed equally in other parts of Germany, showing that our German neighbours are fully as determined, that their high schools of science shall be ahead of those of other countries, as we may be resolved, that our fleet shall be equal to that of any two other nations.

It is well known to most of the readers of this journal, but must be emphasised with a view to a comparison between the provision for scientific education in Great Britain and Germany, that the polytechnics or technical high schools are institutions exclusively devoted to the teaching of science in its practical application to engineering, manufacturing and professional pursuits. They are quite distinct from the universities, which, situated in the same town or in an adjoining city, as the case may be, comprise other faculties besides science, and, although far larger and more important, belong rather to the class of institutions known in this country

as University Colleges. Not far from the polytechnic at Aachen is the University of Bonn; at Munich, and within a few yards of each other, are found the university and polytechnic, and the magnificent institution at Charlottenberg is almost as near to the science laboratories of the Berlin University as is University College to the City Guilds Institute. It must also be remembered that the universities comprise schools of science of the highest grade, for each of which, as at Zürich, Strassburg and Berlin, separate buildings are provided, presided over by professors of European celebrity. In the figures I am about to quote, it will be understood, therefore, that I am dealing with a part only of the accommodation which the different German States have made for the teaching of the higher branches of science.

In order to show the relative sizes of some of the Continental institutions for instruction and research work in technical or applied science, I have obtained plans, accompanied by descriptive matter, of certain typical technical high schools, and have made squares corresponding to the areas covered by the existing buildings. In most cases the buildings erected in the early

building in this country which correctly corresponds with a German polytechnic, although its courses of instruction are restricted to fewer branches of professional work. The Royal College of Science embraces a much wider range of scientific work, but, except as regards its mining department, its functions differ in many respects from those of a technical high school. University and King's Colleges may be described as imperfect and undeveloped universities, the specially technical departments of which would alone correspond to the buildings now under consideration.

Taking the areas of the sites of some of the principal foreign schools, we have the following figures arranged in order:

Site of the	Square metres
Berlin Polytechnic	82,460
„ Aachen „	21,900
„ Darmstadt „	16,150
„ Hanover „	15,294
„ Chemnitz „	12,418
„ Stuttgart „	11,189
„ London—City Guilds College ...	3,344
„ „ Royal College of Science	1,189



FIG. 1.—Electro-technical and Mining Laboratory—Aachen.

seventies have proved too small and ill-adapted or such practical teaching as requires the use of steam power. Separate buildings have accordingly been added for the accommodation of the engineering, chemical, and electro-technical laboratories, for engine and boiler houses, and for other purposes. The areas of these separate buildings I have added together, and where a building consists of a front portion, and of separate wings at right angles to it, as is so frequently the case, I have taken only those parts of the site which the buildings actually cover. With a view to further accuracy I have endeavoured, where the plans enabled me to do so, to reduce the several parts of the building to a uniform height. The figures quoted may be taken, therefore, as approximately correct.

The Central Technical College of London is the only

The relative areas of these sites are shown by the squares in Fig. 2.

If we consider the buildings erected on these sites, we have the following figures representing in square metres the areas already covered:—

	Square metres
Berlin	16,500
Zürich (exclusive of observatory building) ...	15,412
Aachen (exclusive of engineering laboratory, being built)	8,255
Stuttgart	6,375
Darmstadt	6,084
Chemnitz	3,964
London—City Guilds College... ..	1,837
„ Royal College of Science	1,189

The accompanying squares (Fig. 3) show the relative sizes of the buildings.

I have not been able to obtain the dimensions of the building in Hanover, nor have I those of the site of the Zürich Polytechnic.

It will be seen at a glance how very inadequate is the provision in London for the higher scientific and technical teaching, as compared with what is found in even a small German town. But, as has frequently been pointed out, it is not only in the size and arrangements of the buildings devoted to science, that we in England are so

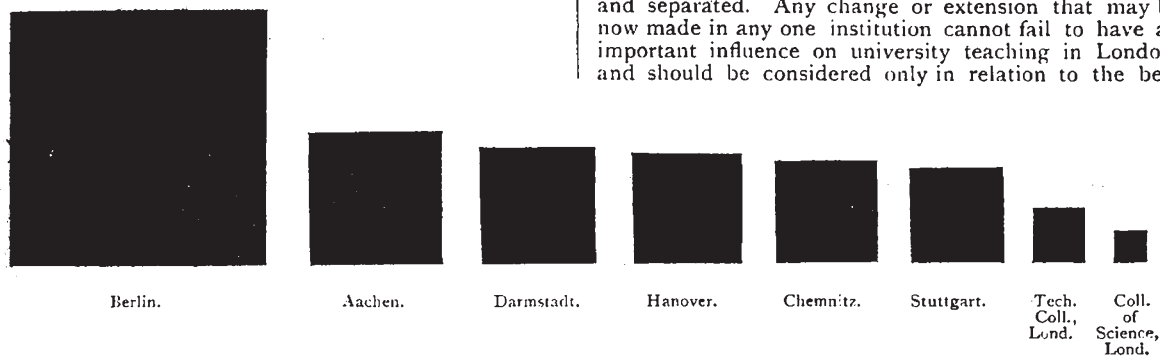


FIG. 2.—Squares showing areas of sites.

far behind our German and Swiss neighbours, but also in the organisation of the instruction. In some of our best schools at home each professor has to do the work of three or four experts abroad. In a German university or polytechnic, there is a large staff of professors, each occupied with a particular section of science, in which he is specially interested, and presiding over a laboratory in which he has time and opportunity to make investigations, with the view of advancing science in some one direction. It is the combination of professorial work and the coordination of teaching that make the German university or polytechnic so powerful a machine not only for scientific training, but also for discovery and research. In London, unfortunately, we have too many separate schools, each under-staffed, and each doing much the same kind of work, and the professors are consequently required to discharge a number of duties which are wisely divided in Germany among separate specialists. The multiplication of the schools, and the overlapping of the functions of the teachers stand in the way of any

possible arrangements for developing and improving the joint facilities which London now offers for scientific education of the highest grade. PHILIP MAGNUS.

THE SCIENCE BUILDINGS AT SOUTH KENSINGTON.

IN NATURE for May 5 we printed the report of the Select Committee of the House of Commons which has recently been inquiring into the Museums of the Science and Art Department, relating to the recent proposal of the Government to build the new laboratories for the Royal College of Science on the east side of Exhibition Road. We have received for publication the following memorial recently presented to Lord Salisbury by Lord Lister, the President of the Royal Society, which has been signed by the president and officers, all the living past presidents, and many fellows of the Society, entirely endorsing the views of the Select Committee, and urging the Government to refrain from a step which is not only contrary to the policy which has been pursued for the last ten years, but which, if carried out, would make the allocation of land at South Kensington for

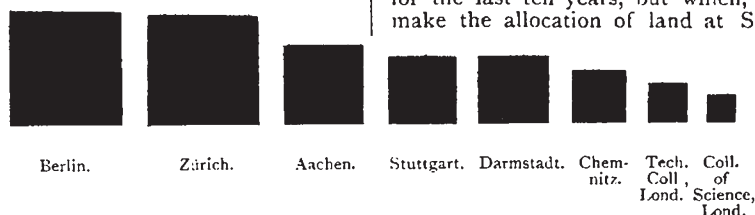


FIG. 3.—Squares showing areas of buildings.

organisation on broad lines of the higher scientific education in London. It appears that a much-needed extension of the Royal College of Science at South Kensington is now under consideration; and it is understood that a more ample site than was originally suggested will be provided for the new buildings on the west side of Exhibition Road, which will bring the Royal College of Science in closer proximity to the Central Technical College. This is as it should be. It is to be hoped, however, that no hasty and half measures will now be adopted. In these days of military and naval expenditure it may be well to point out that

Science and Art purposes respectively ridiculous. Nor is this all. So far as science and science teaching is concerned, we should be landed in a position far inferior to that occupied by such towns as Gratz, Chemnitz, or Aachen, not to speak of some chief cities of the Continent, Berlin, Vienna, Paris.

Memorial to the Most Honourable the Marquis of Salisbury, K.G., F.R.S., Premier and Secretary of State for Foreign Affairs.

I. Whereas in 1890 Parliament voted 100,000*l.* for the purchase of a site at South Kensington upon which to