HEARING IN ANTS.

In a recent number of SCIENCE (Nov. 24, 1899), LeRoy D. Weld describes some experiments upon a number of species of ants, demonstrating a sense of hearing. It may be of interest to record that in 1895 one of my students, Miss E. A. Wagner, who was keeping several species of ants under observation, found one species (not determined) of small black ant which gave unmistakable evidence of hearing. Miss Wagner's work was never completed, so that I can only give, from memory, an inadequate account of her results.

To most sounds this species, like the others studied, was apparently indifferent, and, so far as we could judge, insensible, but to a note of a certain pitch, whether sounded by a violin or by a whistle, the whole colony would react most vigorously, rushing about frantically, tumbling against one another, many of them falling into the water moat surrounding the nest, a thing they never did when undisturbed The appearance was that of extreme agitation. This response was obtained only to sounds of a certain pitch. On first sounding the note the ants which might be resting quietly in a compact group in the nest (asleep?) would apparently be startled to attention, standing tense with erect antennæ. A few of the outermost ants in the group would usually move about a little, but if the sound was not repeated they might return and all the individuals again become quiet. If the sound were repeated several times at intervals the agitation (?) would steadily increase until all the ants seemed fairly frantic, behaving in a way never observed under other circumstances. The reaction was equally decided whether the note was sounded near the nest or fifteen feet away at the opposite side of the room with the back turned to the nest. In only one species was any response observed, and in this species the response was only to a note of a certain pitch.

It is difficult to explain the violent reaction to only this particular note. What connection, if any, it may have with any features of the normal environment of these ants, I cannot suggest.

MAYNARD M. METCALF.

THE WOMANS COLLEGE OF BALTIMORE.

NOTES ON INORGANIC CHEMISTRY.

AFTER having been practically stationary for a number of years, the manufacture of sulfuric acid, which is the greatest of the chemical industries, has lately begun to make new and unforeseen advances. The first of these is the use of cast-iron vessels for concentration and is described by E. Hartmann in the *Chemiker Zeitung*. The great rise in the price of platinum has emphasized the necessity of some more economical material for concentration vessels, and it is found that, unless it is desired to have an acid absolutely free from iron, vessels of cast-iron can be used. The iron should be as free as possible from all impurities and as hard as possible. The acid is concentrated in lead pans to 61° *B*, then run into a small cast-iron vessel in which it reaches 63.5°–64° *B*, at a temperature of 180°. Finally it is run into two concentrating dishes in cascade arrangement, where a strength of 97% to 98% is obtained. The small vessel lasts three to four months and the concentrators from six months to over a year. The loss on wear of apparatus is however no greater than with platinum, and the first cost is insignificant in comparison.

THE second advance in sulfuric acid manufacture is nothing less than a complete revolution, and is described by Lunge in the *Journal* of the Society of Chemical Industry. It is the complete abolition of the lead chamber and towers, even of the use of nitrous fumes as oxygen carriers, and the use of the so-called catalytic power of platinum and other substances to occasion the union of sulfur dioxid and oxygen. In other words it is the utilization of an idea which has long been considered available for the preparation of sulfur trioxid and Nordhausen fuming acid. The Badische Anilin and Soda Fabrik has perfected this invention and is manufacturing its acid practically by this process and other firms are beginning to follow in its steps. Among the catalytic agents which have been used are pyrites, cinders. The principle feature of the Badische invention is the discovery that to obtain good results it is necessary to get rid of the heat of the reaction. With this it is possible to attain 98 per cent. of efficiency. The process is of course of great-

est value for producing the strongest acid, and avoids especially any necessity for concentrating plants. For weaker acid, such as chamber acid, it is probable the old process will always be more economical. The new process has, however, the further advantage of giving an acid exceptionally pure and especially free from arsenic. This would seem at the present outlook to be the most important advance in technical chemistry in the last few years.

J. L. H.

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*CAMBRIDGE UNIVERSITY**

A COMMENCEMENT has already been made with the new Geological Museum which will cost about £44,000, of which sum the fund raised as a memorial to Professor Sedgwick will supply £27,000. The contributions to the Benefaction Fund have made it possible to consider the erection of new buildings for Law, part of the funds for which will, it is understood, be contributed by the trustees of Miss Squire's will, for Medicine, Botany, Archæology and rooms for business purposes and examinations; but it is impossible to say until plans have been drawn and estimates made whether the resources of the University will allow of the erection of all these buildings at the present time.

Although the extreme pressure upon the funds of the University is thus removed and some of the most urgent of long-standing claims can be satisfied, the response made as yet to the Chancellor's appeal will not allow of any of the new developments of University work which many friends of the University consider opportune. In the interests of national progress it is greatly to be desired that laboratories of applied science should not be isolated, but should be established in connection with schools which are already strong in pure science. Technical training in any limited sense of the expression is impossible. In every subject of practical application, whether it be a learned profession or an industrial art, success depends upon breadth of knowledge of the sciences upon which the profession or art is based. Advances in technology are almost invariably due to the application by practical men of principles discovered by those who carry out investigations in pure science. Conversely the strength and vitality of the school of pure science is largely increased when opportunities are afforded to students of passing on to its applications.

The remarkable progress of Natural Science in Cambridge is closely associated with the growth of the Medical School. During the past twelve years a larger number of students have entered for the Natural Sciences Tripos than for any other examination for honors, notwithstanding the fact that but few students are in a position to allow their prospects in life to depend upon the discovery in themselves of a special aptitude for pure science. Almost all those who have since distinguished themselves in various branches of science have commenced their career by preparing to qualify for a profession. The majority of the graduates, for example, who are at present prosecuting researches in the physical, chemical, botanical, zoological, physiological, anatomical and pathological laboratories, making, to the great credit of the University, additions to knowledge which are not exceeded, if they are equalled in amount, by any other university in the world, entered as medical students. The phenomenal growth of the Engineering Department under Professor Ewing is also beginning to produce similar results; students who entered with the intention of becoming engineers have discovered in themselves a special aptitude for pure mathematics or for physics in one of its various branches. Thus experience shows that whereas there can be no doubt as to the advantages which a professional or technical department reaps from the support of a school strong in pure science, the advantages which pure science reaps from the proximity of departments of applied science are not less substantial. An examination of the class-lists, as well as the records of work done after graduation, shows with equal clearness that the older subjects of university culture do not suffer from the rivalry of new departments.

*From the report of the retiring Vice-Chancellor, Dr. Alexander Hill, Master of Downing College.

GRADUATE STUDY AND THE SMITHSONIAN INSTITUTION.

IT will be remembered that a committee representing the American Association of Agricul-