COLLIERY EXPLOSIONS AND COAL-DUST.

UNDER the title of "Great Colliery Explosions and their Means of Prevention" (London: The *Colliery Guardian* Co., Ltd.), Dr. W. Galloway has collected into a small volume a number of papers contributed by him between the years 1872 and 1908 to various publications; these were so scattered that their logical sequence was not always easy to trace, and they gain greatly by being presented in their order and gathered within the covers of a small volume.

The first two papers deal with the connection between colliery explosions and the state of the barometer, and showed, what no one probably doubts to-day, that there is a greater danger of firedamp explosions with a falling barometer than under any other atmospheric conditions. The next paper gives an account of a series of experiments which demonstrated that a violent atmospheric concussion, such as that produced by a shot, can force flame through the gauze of a safety-lamp, so that a lamp, which would be quite safe in a quiescent explosive atmosphere, may initiate an explosion if the same atmosphere is violently disturbed. This fact, like those above referred to, is a matter of such common knowledge to-day amongst miners that they are apt to forget that there ever was a time when it was not known, and it is as well that they should have at hand a reminder as to who it was that first discovered this very important fact.

The remaining papers are perhaps of higher interest than those already mentioned, as they all deal with the part that coal-dust plays in propagating colliery explosions. For a long time the coal-dust danger was either neglected or flatly denied even by the highest mining authorities, and Dr. Galloway deserves the greatest credit for the part he has played in forcing its recognition upon the mining community. It is evident from a perusal of the papers here collected that it was only gradually that the gravity of the danger of coal-dust explosions impressed itself upon Dr. Galloway himself, and that it was quite a long time before he could convince himself that coal-dust was dangerous in the entire absence of fire-damp. Thus in 1876 he disagrees with the opinions expressed by a French engineer, M. Vital, who held that finely divided coal-dust may of itself alone (*i.e.* without fire-damp) give rise to disasters, and he states his definite conclusion that "*a mixture of air and coal-dust is not inflammable at ordinary pressure and temperature*" (p. 57), and goes on to show that when as little as 0·892 per cent. by volume of fire-damp is added the mixture becomes inflammable. Already at this date, however, Dr. Galloway advocated the watering of the roadways in collieries so as to keep down the dust. In 1879 Dr. Galloway had apparently modified his views to some extent, for he then wrote: "It is probable, moreover, that some kinds of coal-dust require less fire-damp than others to render their mixture with air inflammable; and it is conceivable that still other kinds may form inflammable mixtures with pure air" (p. 73). In his first paper in 1882 he still seems to consider the presence of a minute proportion of fire-damp, too small to be detected by a safety-lamp in the ordinary way, which he calls the "*latent*" fire-damp, indispensable to the formation of a dust explosion, but he continued to experiment, and in his second 1882 paper he wrote that his experiments "show conclusively, I think, that fire-damp is altogether unnecessary, when the scale on which the experiments are made is large enough" (p. 111). It is important to note that Dr. Galloway reached this conclusion after six years of continuous experiments, in direct contradiction to his earlier views on the subject, and this fact should of itself have inspired confidence in the matured opinions that he expressed.

The remaining papers in this volume are devoted to an elaboration of this coal-dust theory, but though of undoubted importance, they are less so than the above-quoted series in which Dr. Galloway showed by direct experiment that coal-dust and air form an explosive mixture even in the absence of inflammable gas, and the fact that he was the first to furnish experimental proof of this has established his reputation as an original, accurate and painstaking investigator of colliery explosions; this little volume shows clearly enough the extent to which he has laid the coal-mining community not only of this but of all other countries under a deep debt of gratitude. H. L.

THE EDUCATION IN LONDON OF REFUGEES FROM FOREIGN UNIVERSITIES.

A FEW weeks ago (NATURE, November 26) we gave an account of what is being done to establish an informal Belgian university at Cambridge, for students of the University of Louvain and other universities affected by existing military operations. Both the Universities of Oxford and Cambridge have, so far as we understand, offered a generous hospitality on a large scale to both the staff and students of Belgium universities, but while affording them every facility for quiet study, have not attempted to bring them systematically within their own system. The University of London, on the other hand, is putting at the service of refugee students not merely the teaching facilities of its two incorporated colleges, but also the right to enter its degree courses and to obtain its degrees on exceptionally favourable terms. It is allowing a partial or total remission of fees both for full teaching courses in expensive laboratory subjects, such as engineering and preliminary and intermediate medicine, and for entrance to examinations. It has further made special concessions as to both the matriculation and intermediate examinations, which will make it possible for the students to answer questions in French, and have their knowledge tested on the lines of education they have previously received in their own universities. If the Privy Council approve of the Amendment of Statutes which the Senate of the University is referring to them, a clever student who has come over to London from Belgian or French universities this autumn, will be able to pass the examinations in lieu of matriculation and intermediate by the early spring, and enter at once on his final course.

This interesting experiment to enable deserving students of the allied nations to obtain actual English degrees entails extraordinarily severe work on the administrative and teaching staff of the colleges. King's College has seventy-four of such students, University College sixty-seven, and the Imperial College a certain number. None of them knew English to start with, and special classes have had to be arranged to teach it them. The courses in foreign universities differ greatly from those of English universities, as well as from each other, and infinite care has had to be taken to discover the exact stage in each subject which a given student has reached. In engineering, for instance, in which King's College alone has forty-two such students, the standard of applied mathematics is much lower in the earlier stages in Belgium than in England, while that in pure mathematics is higher. Even allowing for the assistance of the Belgian professors who are being called into council, it is not above the mark to say that the time taken over each refugee student is as much as that over ten English students. Apart from the academic work, the hospitality which the senior common rooms of University and King's Colleges

have extended to these students, many of whom are for the present quite without funds, cannot be left out of account. In regard to the Jewish students, who form a large proportion of the whole, and who are mostly Russian subjects studying at Liège or Ghent, valuable help has been received from the Central Jewish Committee.

This effort, however great the tax it imposes on the colleges, is worth making. It will enable Belgians who are medically unfit to go on active service, and Russians whose military service begins at the end of their university career, to obtain their professional qualifications during the war, and thus fill the depleted ranks of doctors and engineers in their respective countries. It will also spread a knowledge of English university education on the Continent, and not improbably make the University of London an international, as it is already an Imperial, centre of university education.

THE PRODUCTION AT WILL OF EITHER FUNGUS-GERMS, FLAGELLATE MONADS, OR AMŒBÆ FROM THE ULTIMATE SEGMENTS OF SMALL MASSES OF ZOOGLŒA.

AN illustrated article dealing with this question of the heterogenetic origin from small Zooglœa masses of Fungus-germs, Monads, or Amœbæ, written by me, appeared in NATURE of November 24, 1904. That article was prepared at short notice in consequence of a short letter on "Archebiosis and Heterogenesis," which appeared a fortnight previously, and at a time when I was not specially working at this subject. Of late I have been doing much work in this direction, and have made out many very important new points, and can now speak with more precision concerning the changes generally, and the modes of obtaining them.

My results were received with great scepticism, and no bacteriologist has been induced to attempt either to confirm or refute them. The possibility of "infection" has so dominated them, that they have refused to consider the question. Of late, however, three bacteriologists have accepted my request that they should allow me to demonstrate to them my position by their examination of actual specimens. This they did, separately, and as a result neither of them was able to doubt that the Fungus-germs, the Monads, and the Amœbæ were, in truth, derived from the ultimate segments of the Zooglœal masses; nor did they suggest that the very similar developmental changes to be seen in hundreds of Zooglœal masses taken from their respective scums could possibly be accounted for by "infection."

Only one of my friends had any interpretation to suggest in opposition to my own. He started the supposition that what appeared to be bacterial aggregates might "possibly," in spite of their appearance, not actually be of that nature. He suggested that, though taking the guise of bacteria, and though all were similar in appearance, they might nevertheless be some hitherto unknown progenitors of Fungus-germs, of Monads, and of Amœbæ which had aggregated as Zooglœal masses, and subsequently given rise to their respective products.

This wild supposition may, at all events, be taken as an indication that its author could not doubt the fact of the different products coming from the ultimate segments, or imagine that "infection" could account for what he had seen. It was started by one who was absolutely opposed to the very notion of heterogenesis. He was subsequently able to find absolutely no support for his "possibilities," and after a futile search frankly admitted that only bacterial Zooglœas were known, apart possibly from others of an algoid type.

The current notion among bacteriologists concerning the nature and mode of origin of Zooglœas is that adopted by R. Muir in the article, "Bacteriology," in the last edition of the "Encyclopædia Britannica" (vol. iii., p. 161), in which he says:—"The Zooglœa is now known to be a sort of resting condition of the Schizomycetes, the various elements being glued together, as it were, by their enormously swollen and diffluent cell-walls becoming contiguous."

But bacteriologists do not seem ever to have examined the small masses that form in the scum on the surface of a hay infusion. I have been unable to find any reference to them, or of processes of segmentation occurring in any other Zooglœas. I cannot think that those with which we are now concerned are formed in the manner above indicated. All the evidence seems rather to show that as the bacteria rapidly multiply they also excrete the jelly-like glœal material in which they are subsequently found to be imbedded.

Preparation of the Infusions.

One of the important new points recently ascertained is that I can prepare two small infusions at the same time from the same sample of hay, and by allowing one to infuse for three hours at a temperature of 90° F., can feel confident that in the course of three to five days the ultimate products of segmentation of the Zooglœas that form can be made to yield Monads or Amœbæ; while if the other is infused for the same time at 98° F. no Monads or Amœbæ will appear, and the ultimate Zooglœal segments, though formed, and very similar in appearance, will remain apparently stationary for eight to thirteen days, and then begin to show themselves as multitudes of brown Fungus-germs.

It is best to use comparatively new hay, and not that of the previous season. I take a small portion and having cut it into ½-in. lengths, place it in 2-oz. beakers to which water is added just sufficient to cover it. The proportion of the two I have found to be a little more than 30 grains to the ounce of water. As soon as the infusions have been made they are filtered through No. 0 Swedish paper (so as to exclude encysted Kolpodæ and the great majority of Fungus spores) into common one-ounce porcelain pots, until they are about half-full—the depth of the infusion being then only a little more than half an inch. The scum which ultimately forms will be thin, and therefore much more favourable for examination than if it had been thick and formed over a greater depth of infusion. The covers are replaced on the pots, and the dates and temperatures at which the infusions have been made are marked thereon. These covered pots are then mostly kept at room temperature, 62°–64° F.

Examination of the Scum or Pellicle.

The pots are not usually opened until two days have elapsed, as it would be only during the last twelve hours that any very distinct scum begins to form, and that a few very small Zooglœas may be found scattered through it. By the end of the third day the Zooglœas may be very numerous, and will be found to vary much in size and shape. An example illustrating a rather later stage is shown in Fig. 1, in which the little masses are seen to be extremely numerous. Many of these early Zooglœas already show primary processes of segmentation.

In order to examine the scum a small portion is taken up on the point of a scalpel and rotated off on to a drop of distilled water. If thereafter it should be desired to preserve the specimen some 5 per cent.