heavily braided, drawn into Doulton stoneware casing under the footways, and into either Crompton-Davis cast-iron casing or cast-iron pipes under the roadways. At all crossings, and at intermediate places on the foot-ways, brick junction boxes are built. Wherever sufficient space has been found under the footways, the feeders have been laid as bare copper strip, carried on stoneware insulators in concrete culverts. Across all roads, and where there has not been sufficient space for culvert, the feeders are laid in Siemens armoured cable, laid direct in the ground. All the feeders have been designed to have a total drop of 44 volts at full load Potential leads, by which each feeding point is connected back to the station, consist each of three sets of wires, insulated with specially prepared paper, laid up together and covered with the same material, a lead tube being drawn over the whole. All of the cable connections are made by cone connectors, sweated on to the cables, and fitting into gun-metal connecting blocks.

The author concluded by stating that he had endeavoured to describe the arrangement of the plant and mains, and any details in their design and construction which might be of interest, without discussing general principles or the advantages or disadvantages of any individual system.

In the discussion which followed the reading of the paper, the chief point raised was the advisability of using a dual system of supply; but the author very well disposed of the objections raised in this direction by pointing out that the area to be dealt with consisted of two districts differing widely in character. For one the high pressure alternating system was most desirable, and for the other a low tension system. It is easy, as Mr. Burstall said, to maintain that either system is wrong if the disadvantages of that system are given undue prominence, and the advantages of the rival system are brought prominently forward. Of course, the benefit of the high-tension alternating system consisted in the saving of copper, but that was a thing that perhaps would not work out in practice exactly in the same way as it was presented in theory. On paper, a larger main was required for low-tension transmission, but practically there was often no saving in copper. As a matter of fact there is, however, an economy in material in the feeders. It becomes a question of balance of advantages, whether certain points shall be sacrificed to the saving of copper. Mr. Burstall stated that so far as Edinburgh was concerned, no less than six schemes were worked out in detail before it was decided to adopt the plans described in the paper. The discussion also ranged over the question of superheating steam, the efficiency of feed pumps, and various other engineering details, which, however, it is not necessary here to consider in connection with an electrical paper, especially as no new facts of importance were added to one's information upon these matters.

The second paper, on the Lille experiments with ropes and belts, does not need any extended notice at our hands. The Société Industrielle du Nord de la France had the question of transmission of power brought before them by a paper by M. V. Dubreuil, and it being considered advisable to obtain more information on this subject, a commission was appointed, and the Institution of Mechanical Engineers was invited to send a representative. Various trials were made with ropes and belts under different conditions. Owing to the want chiefly of dynamometer records, no very exact figures could be deduced from the experiments, so far as the actual power transmitted was concerned. An effort was made to make the experiments comparative as between ropes and belts, by keeping the experimental conditions in both cases constant. It is somewhat doubtful, however, to what extent these efforts were attended by success. Generally speaking, it may be said that the results arrived at showed the power absorbed by transmission to be equal, whether ropes or belts were used. This conclusion, however, must be accepted with some reserve.

Prof. Capper in his paper, commenting on the experiments, attempted to arrive at some conclusion as to the efficiency of the whole system. His figures were excellently worked out, but he himself acknowledged that the data upon which he based his calculations might be open to question. Although, therefore, the experiments may not be of great use to future designers of machinery, the thanks of English engineers are none the less due to the Société Industrielle for their courtesy in inviting the Institution of Mechanical Engineers to send a representative to watch the proceedings. The Institution is also to be congratulated in being able to send so competent an observer as Prof. Capper as their representative.

A long discussion followed the reading of the paper, which occupied the rest of the evening. Perhaps the most interesting part of it were the remarks of Mr. Crompton, who stated that the question of transmission by ropes and belts did not possess any longer the importance it once did, as within a few years the silent, flexible connecting rod, called electricity, would supersede all other methods of transmission, so that ropes and belts would only be found exhibited in museums, as mechanical curiosities of a past era.

RECENT FISHERY LITERATURE.

THE general report for 1894 of the Fishery Board for Scotland contains evidences of the revolution which is quietly but steadily effecting a complete change in the methods of the fishing industry. There is a further falling-off in the number of fishermen and fishing boats engaged in the herring and line fishing. The sailing craft continue to give way before steam trawlers and steam liners, and the competition for the best markets is bringing about an increased centralisation of the fishing industry. The smaller and healthier creeks and villages are being gradually depopulated, and the larger ports are becoming overcrowded. The summer herring fishing is being forsaken for line fishing, which can be prosecuted all the year round. Steam liners are consequently increasing rapidly in number, and during the past year have proved most successful. Indeed, in spite of the falling off in the means of capture, the decrease in the total quantity of fish landed, as compared with the returns for 1893, amounted to only 19,000 cwts. This state of things may be attributed to the fact that the steam trawlers and liners are able to proceed much further out to sea than sailing craft, and are able to fish over fresh grounds where large catches are frequently obtained. Being larger and stronger, moreover, these vessels are to a great extent independent of wind and weather, which seriously affect the movements of the smaller sailing boats. Herring were locally plentiful, and of a quality never excelled within modern times. They were especially abundant in the Orkneys and Shetlands—where the catch was double that of 1893—and in the Campbelltown area; but the herring fishery in the Hebrides was again a failure, and this is the more to be regretted as Stornoway, the most important centre for ling, also exhibited a large falling off in the returns of the latter fish. It is gratifying to notice a slight increase in the returns of flat fish, especially in view of the complaints of the depletion of grounds frequented by them. The increase may, however, be due to the hauls made by steam trawlers working on fresh and more distant grounds. For the first time in the Board's returns, a table is given of the number of persons engaged in Scotch fisheries on sea and land; there are more than 117,000 people taking some part in the various branches of the industry.

The report of the same Board on Salmon Fisheries shows that the season of 1894 was in most districts below the average. On the other hand, salmon disease appears on the whole to have been less prevalent during 1894 than in the previous year.

In an interesting and amusing article on the North Sea fisheries ("Journal of the Marine Biological Association," vol. iii., 1895), Mr. Holt devotes especial attention to the question of the destruction of immature fish. The fact that there has been a diminution of the fish supply during recent years seems to be thoroughly established, although the improved boats and methods of fishing render this decrease less striking than might otherwise be the case. The alleged cause of this diminution is over-fishing, that is to say over-trawling, but inshore trawlers, shrimpers, and other fishermen do not appear to be blameless in the matter. During some years' residence at Grimsby, Mr. Holt has collected statistics on this question. They are necessarily incomplete, as time and opportunity did not permit of wide investigation; they are, however, fairly complete in the case of the plaice, one of the most important of our flat fishes, and Mr. Holt's evidence concerning this fish is very striking. He states that during a whole year's trawling on the North Sea grounds 57 per cent. of the plaice brought to shore were sexually immature, and had thus never had a chance of reproducing their species, and so contributing to the maintenance of the supply. In the Conference of 1892 the size limit for plaice was made 10 inches; they are marketable at this size, although not sexually mature, for Mr. Holt finds that as a rule North Sea plaice are not mature until they attain a length of 17

inches. Fish vary in size under different conditions and in different areas, and on the south-west coast the limit of size for maturity in plaice is 13 inches according to Mr. Cunningham. An immense number of the small plaice brought to market are caught on the eastern grounds; and this area forms also a nursery and spawning haven for turbot, brill and soles. The number of plaice above 10 inches on these grounds is inconsiderable; and if a size limit of 13 inches for plaice brought to market were enforced, even during the spring and summer only, such a limit would suffice to keep trawlers off these grounds, which would thus be left unmolested. In conclusion, Mr. Holt considers various remedial measures for checking the depletion of the North Sea grounds, and of enabling the fish supply to recover; but the only practicable method of attaining this end at present is by legislation based on the principle of the size limit.

THE FORMATION OF BACTERIAL COLONIES.[1]

THE author has examined the details of development of the colony from a single spore, in numerous species, by employing microscopic plate-cultures, which can be kept under observation under a one-twelfth and even a one-twentieth oil immersion, or by making pure *Klatschpräparate* of the growing colony on cover-slips covered with a thin film of gelatine.

He finds many factors of importance in affecting the form, extent, rapidity of growth, and other characters of colonies. The elasticity of the gelatine, the presence of moist films on the surface of the gelatine, the rate of (slight) liquefaction, &c., all being of importance, in explaining the shapes, &c., of submerged colonies—"whetstone shaped," moruloid, spherical, or lobed colonies—the mode of emergence and spreading over the surface of the gelatine, the formation of radiating fringes, iridescent plates, &c.

Exposure to light during the development of liquefying colonies may profoundly affect their shape and other properties, a phenomenon closely connected with the retardation of liquefaction and growth. Pigment bacteria may give rise to perfectly colourless races when cultivated under certain conditions, and the colour restored by again changing the conditions, a fact which the author has not only confirmed with red forms, but which he shows to be true of a violet bacillus. Species commonly described as non-motile show active movements under certain conditions, and the sizes of bacteria are not constant in different regions of one and the same colony. Details have been worked out for series of types, the extremes of which differ considerably in liquefying power, and essential difference in the appearance of a colony may depend on the amount of liquefying power evinced.

Some curious cases of travelling films, the lobes and contorted tresses of which move like amœbæ over the surface of the gelatine, were also examined.

The facts point to (1) differences in colonies even of one species may depend on much more subtle differences in cultures than are usually recognised; (2) varietal differences may occur in two bacilli of the same species (isolated from the river), due to the different vicissitudes the two individuals have been subjected to during their sojourn in the water; (3) the difficulties met with in diagnosing "species" of bacteria with the aid of works of known authority, are partly due to varieties of the same species being recorded by different observers under different names, and the author thinks some more consistent pre-arranged plan of working out the characters of such forms should be developed by bacteriologists than at present exists.

A False Bacterium.

The author has isolated from the Thames a form which gives all the ordinary reactions of a bacterium in plate-cultures and tube-cultures in gelatine, agar, potato, broth, milk, &c.

It is a rod-like form, 1 μ thick, and up to 2 or 4 μ long, stains like a bacillus, and cannot be distinguished from a true Schizomycete by the methods in common use.

On cultivating it under high powers—one-twelfth and one-twentieth oil immersions—from the single cell, however, it is found to form small, shortly-branched mycelia, the growth and segmentation of which are acropetal. This turns out to be a minute oidial form of a true fungus.

Its true nature can only be ascertained by the isolation and culture through all stages from the single cell, according to the original methods of gelatine cultures of Klebs, Brefeld, and De Bary, which preceded and suggested the methods employed by bacteriologists; and the facts discovered raise interesting questions as to the character of alleged "branching" bacteria on the one hand, and the multiple derivation of the heterogeneous group of micro-organisms, termed bacteria in general, on the other.

[1] Abstracts of two papers, read before Section K of the British Association at Ipswich by Prof. H. Marshall Ward, F.R.S.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The following have been appointed Examiners in Natural Science for the current academical year:—Physics: Dr. O. J. Lodge, F.R.S., and Mr. L. R. Wilberforce. Elementary Physics: Mr. H. F. Newall and Mr. S. Skinner. Chemistry: R. Meldola, F.R.S., and Mr. W. J. Sell. Elementary Chemistry: Mr. F. H. Neville and Dr. S. Ruhemann. Mineralogy: Prof. N. Story-Maskelyne, F.R.S., and Mr. H. A. Miers. Geology: Prof. G. A. J. Cole and Mr. H. Woods. Botany: Dr. H. M. Ward, F.R.S., and Mr. H. Wager. Zoology: Prof. S. J. Hickson, F.R.S., and Mr. S. F. Harmer. Elementary Biology: Mr. A. C. Seward and Mr. J. J. Lister. Anatomy: Prof. A. Macalister, F.R.S., and Prof. A. M. Paterson. Physiology: Mr. W. B. Hardy and Prof. W. D. Halliburton, F.R.S. Pharmaceutical Chemistry: Mr. A. Ivatt and Mr. R. H. Adie.

Dr. Glaisher, F.R.S., and Mr. R. T. Glazebrook, F.R.S., of Trinity College, and Prof. G. B. Mathews and Mr. A. E. H. Love, F.R.S., of St. John's College, have been appointed Examiners for Part II. of the Mathematical Tripos; and Prof. Ewing, F.R.S., Prof. Reynolds, F.R.S., and Mr. J. B. Peace, of Emmanuel College, have been appointed Examiners for the Mechanical Sciences Tripos.

The twenty-second annual report on the local lectures has just been issued. It touches upon a number of interesting questions. Of the work temporarily undertaken for County Councils three years ago, the only portion that remains vigorous is that carried on in connection with the Norfolk County Council in the preparation of teachers in elementary schools to teach science subjects in evening classes. These courses, given in the county of Norfolk, have been supplemented by practical laboratory work in Cambridge during the Long Vacation, which has been attended by teachers holding scholarships from the Norfolk Council. The Syndicate state in the report that they are persuaded that this is a work of great value, and that they believe that it is in this direction, rather than by the provision of ordinary technical courses for rural audiences, that they can now best aid the technical education work of County Councils. During the past session the scheme of certificates has been remodelled so as to encourage more continuous and systematic work, and has already begun to show good results. The most important part of the report is that in which the Syndicate announce their intention to appeal for funds to enable the University to develop and extend the work in a more systematic way by placing particular districts in charge of superintendent lecturers, who will form a direct link between the district and the University. Appended to the report is a special report by Dr R. D. Roberts, the secretary for lectures, in which a large scheme for the future development of the work is sketched and practical proposals suggested.

A DIRECTORY of Science, Art, and Technical Colleges, Schools, and Teachers in the United Kingdom, by Mrs. R. S. Lineham, has been published by Messrs Chapman and Hall. The directory will undoubtedly prove of great value to all who are concerned with scientific and technical education. It contains a list of schools arranged alphabetically according to towns, with the names of secretaries, principals, and teachers, and the number of students taught in each subject. There is also an alphabetical list of names and addresses of teachers of science, art, and technology, arranged under the headings of subjects taught. Other information of particular use to teachers under the Science and Art Department, and needed now and then by all promoters of elementary scientific education, will be found in the volume. Complete the directory is