and the systematic study of corrosion in condenser tubes of various composition under conditions as nearly like those of practical service as possible in an experimental condenser plant set up by the committee at Liverpool University. The results as stated in the report are remarkable, and diverge widely from the views generally accepted hitherto. The examination of material from service did not lead to any conclusive results, but the data furnished by the experimental plant—so far as they yet go—confirm the results of the small laboratory experiments. The report deals entirely with the process of corrosion by dezincification, which the authors have found to be the most common form of corrosion, although it appeared in the discussion that they admitted that pitting does occur in the absence of dezincification. They find, however, that none of the alloys tested by them undergo selective corrosion or dezincification when exposed to sea-water at the ordinary temperature, but they are all subject to it at higher temperatures, the process becoming vigorous towards 40° C. The action of dezincification is connected by the authors with the formation of a basic zinc chloride, or of zinc hydroxide, which is found attached to the surface of the tube, and under these patches the metal is dezincified. The action of this basic salt is described as regenerative and dependent upon the presence of dissolved oxygen in the water. The experiments of the authors dealt with four alloys, viz. brass, containing copper 70 per cent., zinc 30 per cent.; Muntz metal, containing copper 61 per cent., zinc 39 per cent.; "Admiralty" brass, containing copper 70 per cent., zinc 29 per cent., and tin 1 per cent.; and a special alloy, containing copper 70 per cent., zinc 28 per cent., and lead 2 per cent. As regards resistance to dezincification at 40° and 50° C. the last-named proved superior to the others, the Muntz metal and 70/30 brass being the least resistant. Another interesting and surprising result obtained by the authors is that dezincification does not appear to be due to electrolytic action; they find—contrary to what has been generally believed—that the presence of particles of carbon, or similar materials, even including a plug of pure copper screwed into the tube, does not give rise to local action of this kind. The report contains a detailed account of the experiments upon which these conclusions are based, and thus constitutes a record of work which must be of fundamental importance in the future study of the whole question of corrosion in copper alloys.

Of considerable general interest also was the paper on the intercrystalline cohesion of metals by Dr. W. Rosenhain, F.R.S., and Mr. D. Ewen, of the National Physical Laboratory. The authors of this paper elaborate their theory that the crystals of a metal, forming a crystalline aggregate, are held together by a thin layer of the same metal in the amorphous or undercooled liquid condition. The experimental evidence offered in their first paper they now supplement by evidence obtained from an entirely different direction. In the present paper the relative mechanical properties of the crystals and of the amorphous cement are discussed, and the authors indicate that while at ordinary temperatures the cement would be much harder and stronger than the crystals, at temperatures near the melting point this relation must be reversed, since the undercooled liquid cement must pass into the ordinary fluid condition in a gradual and continuous manner while the crystals will soften suddenly on melting. Just below the melting point, therefore, the theory indicates that the crystals could be pulled apart from one another without undergoing any distortion, thus giving a perfectly brittle fracture—the brittleness being entirely intercrystalline. The authors show such brittle inter-

crystalline fractures in the case of the purest lead, tin, aluminium, and bismuth, the lead fractures being particularly striking in appearance. At the meeting these data were supplemented by a similar brittle fracture obtained in a bar of the purest gold which had been prepared for the authors by Dr. T. K. Rose, of the Royal Mint. The discussion showed that the theory of an amorphous cement is still received with some reserve, but it was admitted that the accumulation of experimental evidence has considerably strengthened the position of the theory.

The list of papers dealt with at the meeting included nine others, among which those of Dr. T. K. Rose on the annealing of gold, of Dr. W. M. Guertler on the specific volume and constitution of alloys, of Prof. S. L. Hoyt on the constitution of the copper-rich kalchoids, or alloys of copper, zinc, and tin, of Mr. J. H. Chamberlain on volume changes in alloys, and of H. Garland on the metallographic study of some Egyptian antiquities, were of considerable interest. The discussions were in all cases vigorous and full of interest, and the meeting marks a decided advance in the development of the Institute of Metals.

THE PAST SUMMER.

BBROADLY speaking, the past summer was essentially dry, generally cool, and particularly sunless considering the small amount of rain.

The reports issued by the Meteorological Office show that for the whole period of thirteen weeks which comprise the summer the mean temperature was below the average in all parts of the United Kingdom except in the north of Scotland, the deficiency being greatest over the east and south-east of England. The mean temperature was higher than in 1912 over the entire kingdom with the exception of the east of England, but it was everywhere much cooler than in the abnormally hot summer of 1911, the difference being greatest in the midland, southern, and eastern districts of England.

The sunshine was deficient over the eastern portion of the kingdom, but generally in excess in the western districts. The hours of bright sunshine were everywhere more numerous than in 1912, but far fewer than in 1911. Taking the British Isles as a whole the total hours of sunshine were 492 in 1913, 373 in 1912, and 679 in 1911.

The average rainfall for the whole of the British Isles for the three summer months—June, July, and August—was 4.47 in. this year, 12.92 in. last year, and 6.27 in. in 1911; the average number of rainy days are thirty-five this summer, sixty-one last year, and thirty-seven in 1911. The rainfall this summer was less in all districts of the United Kingdom than in the dry summer of 1911. In the south-west of England the aggregate summer rainfall was only 39 per cent. of the average, in the north-east of England 44 per cent., and in the midland counties and the south-east of England 45 per cent. The wettest districts were the north of Ireland, 68 per cent. of the normal, north-west of England, 67 per cent., and north of Scotland, 66 per cent.

At Greenwich, which fairly represents England, the weather at the end of May was persistently hotter than at any time during the summer. On six consecutive days the sheltered thermometer rose to 80° or above. Throughout the summer, from June to August, there were only four days with 80° or above, the average number of such warm days for the summer is fourteen, and in 1911 there were thirty-seven days as warm.

The following are the chief meteorological results at Greenwich:—

1913	Temperature						Rainfall			Sunshine	
	Mean highest day	Diff. from average	Mean lowest night	Diff. from average	Mean	Diff. from average	Rainy days	Total	Diff. from average	Hours	Diff. from average
June ...	71	0	50	0	61	0	12	8	In. -1'33	204	+22
July ...	68	-6	52	-1	60	-4	12	12	2'01 +0'12	95	-91
August ...	71	-2	52	-1	62	-1	9	11	2'07 -0'27	143	-34
Summer...	70	-3	51	-1	61	-2	22	31	4'60 -1'45	442	-103

It is seen that June was very dry, but in other respects fairly normal. July had a fairly normal rainfall, but only about one-half of the average sunshine, whilst the temperature was exceptionally low. August was very dry until quite the close of the month, when exceptionally heavy rains fell over the south-eastern portion of England; at Greenwich the total for the last three days of the month was 1.22 in.; both sunshine and temperature were deficient.

CHAS. HARDING.

A MEMOIR ON THE ARTHROPOD EYE.¹

CONSIDERABLE progress has been made of late towards the elucidation of the structure of the arthropod eye. Prof. G. H. Parker, of Harvard, was the first seriously to attack the more intricate problems of its structure, and his insight was such that most of his work stands unchanged even after the more recent elaborate researches of Hesse, Schneider, and others. In the present paper Dr. Trojan has, in addition to his own researches, verified or corrected the observations of these later investigators, whose work had summarised and illuminated the results of earlier writers.

It will be of profit to mention briefly the interesting points that Dr. Trojan has been able to add to our knowledge. The corneal cells are not "tile-shaped," but they are broader distally than proximally, so that they appear triangular in transverse section. The author is unable to support Schneider's observation that they are four in number, but agrees with Parker and Hesse that there are only two. The structure of the crystalline cells (cone cells) differs in one respect from that described by other writers; the upper part, the "Zapfen," is abruptly cone-shaped distally, and passes between the corneal cells to the facet. The general structure of the reticular cells and rhabdome is as Parker and later writers have described, but Dr. Trojan supports Hesse's opinion (and differs from Parker and Schneider) that there is no "zwischen-substanz" (matrix) between the "stiftchen" (fine rods) composing each half-plate of the rhabdome. The innervation of the rhabdome is effected as Hesse described, the nerve fibrillæ passing up the outer side of the reticular cell, round the nucleus, and terminating on "knöpfchen" as the base of the "stiftchen" composing the lamellæ of the rhabdome. Three optic ganglia are described.

The most important part of the paper is devoted to a study of the pigment of the eye in darkness and light; this, however, is best consulted in the original. There are only two pigment-bearing cells which form a continuous tubular sheath enclosing the whole ommatidium from the crystalline cones to the bundles of nerve fibrillæ under the basement membrane. The author's observations on the movements of the pigments of these cells, and also of the non-pigmented tapetum cells are of considerable interest.

In the course of the paper Dr. Trojan deals successively, under separate headings, with the different

¹ "Das Auge von Palaemon Squilla." By Dr. E. Trojan. Denk. d. Kais. Akad. d. Wiss. math-naturw. Klasse. Bd. 88. Wien, 1912. 54 pp. +6 pl.

elements of the eye, giving an exhaustive anatomical and historical account of each, an arrangement which is lucid and very easy to follow. The plates illustrating the paper are very fine—we wish we could believe they could have been as exquisitely reproduced in this country—though we should have preferred to have had more of the author's own drawings in place of the photographs, beautiful as they are.

Dr. Trojan's paper is an important contribution to the literature of the arthropod eye, not only for the original matter it contains, but also as a critical review of the work of previous observers.

H. G. J.

BIOLOGY OF AQUATIC PLANTS.

DR. W. H. BROWN has contributed an important paper on the biology of aquatic flowering plants to *The Philippine Journal of Science* (vol. viii., pp. 1-20), under the title, "The Relation of the Substratum to the Growth of Elodea." He confirms the statements of previous observers that in this and in other submerged plants there is a "transpiration current" of water up the vessels of the stem, but his experiments lead to the conclusions that this current is simply a necessary consequence of the physical construction of the plant, and that the passage of water through a submerged plant does not show that the movement is of advantage to the plant by causing condensation of nutrient salts or that the roots are of advantage as absorbing organs.

Dr. Brown gives tables showing the relative growth of Elodea with and without addition of carbon dioxide to the water, in tap water, and in Knop's solution, with and without soil, rooted in and simply anchored over soil or sand, &c., and summarises the results as follows. Sufficient carbon dioxide to keep Elodea growing or even alive does not diffuse from the air into the water during winter and spring; the substratum probably serves as an important source of this gas. Elodea is not dependent on its roots for absorption of mineral salts, the chief function of the roots being to anchor the plant to the soil, which is advantageous when the soil contains organic matter and gives off carbon dioxide; plants rooted in good soil grow better than those anchored over the same soil. When carbon dioxide was supplied by a generator instead of by the soil, rooted and anchored plants grew about equally well; with similar soils, and no external supply of carbon dioxide, floating plants grew better than rooted ones, the air being in this case the source of carbon dioxide.

The author's work is of great interest with reference to the relation between the growth and abundance of plankton organisms (which form a large proportion of the food of fishes) and of larger water plants, and has obvious economic bearings; for instance, his experiments would seem to show that the larger submerged plants compete with the plankton algæ for both carbon dioxide and mineral salts, and must therefore be detrimental to their growth.

F. C.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—A course of twelve post-graduate lectures on "Conductors for the Electrical Transmission of Energy" will be delivered at University College by Prof. J. A. Fleming, F.R.S., beginning on October 29. The course, which is intended for post-graduate students and for telegraphic and electrical engineers, engaged in practical work, will be divided into two parts, which may be attended separately. Part i. will