Letters to the Editor.

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Photographic Plates for the Extreme Ultra-Violet.

IN recent years there have been a number of attempts to improve the photographic methods, perfected by Schumann, used in the investigation of the ultra-violet, so far without any very striking results.

Recently Mr. David Mann and I have been making some experiments with the daguerreotype process. The results, though interesting, are so far of no great practical value. It is not difficult to prepare a surface which will be very sensitive in the region about wave-length 1850 Å.U., and on two or three occasions we have obtained records extending to wave-length 584 Å.U., but in general the behaviour of the plates in the extreme ultra-violet is capricious and unsatisfactory.

Duclaux and Jeantet (*Journal de Physique*, ii., 1921, p. 154) have described a way of "Schumannising" an ordinary dry plate by treating it with sulphuric acid, and recently Aston has referred to the same process. M. Duclaux has been so kind as to send me some specimens of the results he has obtained. He informs me, however, that he prefers another method which he and his colleague have discovered, described in their article just cited. His experiments were confined to the region of the spectrum which may be investigated with a quartz prism spectrograph; I have continued them into the extreme ultra-violet.

The procedure is extremely simple. A fast commercial photographic plate (I have employed a "Seed 30") is coated with a thin film of a colourless paraffin oil. It is then exposed in the usual way in a vacuum spectroscope, the oil is removed with acetone and the plate is developed. The results are nearly, though not quite, as good as those which I have obtained with the most sensitive Schumann plates prepared according to the old method; it is quite easy to get a record of the strong helium line at 584 Å.U.

The success of the process evidently depends on fluorescent action; I have tried a number of different kinds of oil, and I find that "Nujol," a very pure oil sold in this country for medical purposes, yields good results.

I feel sure that this discovery of Duclaux and Jeantet will prove a real blessing to all spectroscopists who work in the extreme ultra-violet.

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June 28.

The Presence of Urease in the Nodules on the Roots of Leguminous Plants.

AFTER the discovery of urease in the Soya bean by Takeuchi in 1909, the presence of this remarkable urea-splitting enzyme was soon recognised in the seeds of many leguminous plants. On the other hand, while the occurrence of the enzyme in seeds from widely different varieties of plants has been recorded in recent years, its absence from the seeds of several Leguminosæ has also been noted.

So far as we have been able to ascertain, the peculiar root nodules of leguminous plants have not hitherto been tested for urease. Experiments carried out in this laboratory in conjunction with Mr. J. V. Collins have revealed the presence of the particular enzyme in all the cases examined. Crushed nodules taken from the well-washed rootlets of *Trifolium procumbens*, *T. pratense*, *T. repens*, *Vicia sativa*, *Medicago sativa*, *Galega officinalis*, various lupins, and the garden pea, were placed separately in a two per cent. solution of urea (sterilised by saturation with toluene) to which a few drops of neutral phenol-red solution had been added as indicator. A purple-red colour, due to ammonia generated from the decomposition of urea, was gradually developed in the solutions, after they had been maintained at 55° for about an hour. Several control experiments showed that ammonia was not generated in the absence of urea, and that the solution of the latter alone did not change the colour of the indicator under the above conditions. Also, rootlets not bearing nodules, and roots taken from plants belonging to several different natural orders, failed to give any evidence of the presence of urease. Judging from qualitative experiments, nodules from the white and the yellow tree lupin appeared to be the most active of those examined.

From these observations it must be concluded that the nodules on the roots of leguminous plants possess an additional function to the one which they have been known to perform since Hellriegel's discovery. While we have not found urease in any roots devoid of nodules, clear evidence was obtained of its presence in the cylindrical tuberous growths developed from the rootstock of the lesser celandine (*Ranunculus Ficaria*). This is the only case so far in which the enzyme has been detected in the adjunct of a root outside the leguminous family of plants.

An interesting demonstration of the presence of the enzyme can be made without crushing the nodules. The entire root cut from a young pea plant, or preferably from a young lupin, as it usually carries larger nodules, is immersed in a solution of urea containing a liberal supply of the indicator (neutral phenol-red). The action of the enzyme is allowed to continue until the solution has attained a rich purple-red colour, which of course requires a much longer time than if the nodules had been crushed. The root is now removed from the solution, rinsed for a few moments under the tap and then placed in water to which a few drops of the indicator have been added. The diffusion of alkaline solution from nodules into the outer liquid can be readily observed by the zone of colour which forms in the solution directly round the nodules.

While the first part of this experiment illustrates the relatively feeble activity of the nodules *in situ*, if the root be now washed in running water until the colour of the indicator is no longer affected, it will be found that when immersed again in a solution of urea the rate at which the latter is decomposed will be much greater than when the nodules were tested originally. This obviously suggests that urease is produced within the nodules during contact with the urea solution. Under natural conditions the micro-organisms present in the nodules are probably concerned in the generation of the enzyme as required. In our experiments the antiseptic power of toluene was apparently insufficient seriously to affect their activity. Pending a more extended investigation of the subject, our preliminary observations seem worth recording.

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