potassium nitrate as the source of nitrogen. It oxidises ammonia directly to nitrate without passing it through the intermediate step of nitrite formation as do the group of bacteria known as nitrifying bacteria. The nitrate producing power, moreover, is manifest very quickly under such conditions—much more so than is true of the nitrifying bacteria. It is apparently a facultative ærobe. In addition, it possesses the power of completely decomposing petroleum without apparent gas formation aside from the end-product, gaseous carbon dioxide.

We have noticed in the literature two or three cases in which organisms isolated from soil were described as possessing the power to oxidise ammonia directly to nitrate. These reports have never been confirmed, and the other powers attributed to our organism above have not been indicated in such earlier reports. A full account of our investigation with this remarkable organism will be published elsewhere, together with a comparison of our results with those of Kaserer, Söhngen, and others whose work has a bearing on the subject under discussion.

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[1] *J. Bact.*, vol. 22, No. 3, p. 183 ; Sept. 1931.

Periodic Precipitation.

Prof. J. W. McBain has directed attention [1] to the very beautiful experiments carried out by Dr. H. W. Morse, an account of which was published last year in the *Journal of Physical Chemistry*, together with thirty-two remarkable photomicrographs illustrating various types of periodic precipitation in aqueous solution in the entire absence of gels. As Morse points out, it follows that "no gel . . . is necessary for periodic precipitation". He further states that preliminary measurements indicate that ring formation in water follows the same rule as in gels, namely, that the ratio $\frac{d_3 - d_2}{d_2 - d_1} = k$, where k is a constant ratio of increasing distance between neighbouring rings. The two phenomena thus appear to be due to essentially the same cause.

Morse suggests as an explanation for periodicity of precipitation in aqueous solutions that there is a rapid change at the point where the ring appears, due principally to the diffusion of the reacting substance, resulting first in saturation with the substance of the precipitate ; then in a rapid increase in the degree of supersaturation ; and finally in 'release' of supersaturation, this release taking place in the absence of nuclei of the solid phase.

In 1922, when studying periodic precipitation of silver chromate in gelatin, we suggested [2] that the distance between successive rings is determined by the difference between the rates of diffusion and of precipitation in the gel ; we also showed that protective colloids tend to retard the velocity of such reactions as involve a change of state. Morse's experiments would appear, therefore, to support our view that the main effect of the gel is to retard the 'release' of supersaturation and thus to enhance the relative effect of diffusion, this resulting in an increase in the distance between successive rings, other things being equal, over that in the absence of the gel.

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[1] Nature, **128**, 1042; Dec. 19, 1931.
[2] *J. Chem. Soc.*, **121**, 472 ; 1922.

Photoreduction of Carbonic Acid, Bicarbonates, and Carbonates to Formaldehyde.

In these laboratories we have been carrying on experiments on photosynthesis in tropical sunlight for a number of years.[1] We have been able to obtain formaldehyde by the exposure of solutions of carbonic acid and bicarbonates to tropical sunlight in presence of various inorganic and organic photocatalysts.

Now we have been able to reduce carbonic acid, carbonates, and bicarbonates to formaldehyde by means of metallic magnesium and zinc. The yield of formaldehyde in light is considerably greater than that in the dark. Contrary to the observations of Fenton,[2] we could not detect any formic acid either in sunlight or in the dark. It should be pointed out here that Fenton carried on his experiments only in the dark, and obtained formic acid as the main product by the action of an amalgamated magnesium rod on carbonic acid. The chief importance of these experiments consists in the fact that the yield of formaldehyde obtained in our photoreduction experiments is much greater than hitherto obtained by any previous worker. Moreover, we have been able to increase the yield further by the addition of photosensitisers like zinc oxide.

We have found that the photoreduction of these substances can also be effected by ferrous carbonate. These experiments lend considerable support to the view previously announced by us that chlorophyll, besides being an optical sensitiser, also acts as a reducing agent.

From 100 c.c. of a 10 per cent solution of potassium bicarbonate with 1 gram of powdered magnesium in presence of zinc oxide after an exposure of five and a half hours to sunlight, the yield of formaldehyde is 0·0045 gm. No reducing sugar could be detected in these photoreduction experiments with powdered magnesium.

Further work in this direction is in progress.

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[1] Dhar and Sanyal, *J. Phys. Chem.*, **29**, 926 ; 1925 ; Gopala Roa and Dhar, *J. Phys. Chem.*, **35**, 1418 ; 1931 ; *ibid*, 1423 ; Dhar, Roa, and Ram, *Trans. Farad. Soc.*, vol. **27**, 554 ; 1931.
[2] Fenton, *J. Chem. Soc.*, **91**, 687 ; 1907.

Helmholtz or Kelvin Cloud Waves.

It is of some historical interest to notice that the habitual use of the phrase 'Helmholtz Waves' to describe parallel rolls of cloud produced in the transverse direction by a wind in an upper region blowing over stationary air below is only partly justified ; and many students of hydrodynamics are unaware of Kelvin's work in this connexion. It is true that Helmholtz in 1889 [1] worked out the theory of these waves and applied it to clouds. But, as he pointed out in a footnote, the general theory of such waves between two media in relative motion had been given by Kelvin in 1871 [2]; so while the meteorological application was due to Helmholtz, it was Kelvin who provided the essential hydrodynamical explanation.

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[1] *Sitz. Ak. Wiss. z. Berlin*, 761-780 ; or *Wiss. Abh.*, **3**, pp. 309-332.
[2] *Phil. Mag.*, **42**, pp. 368-370 ; "Math. and Phys. Papers", **4**, pp. 76-79.