

and Shoup¹⁰ on the effects of chloroform, urethane, epinephrine and other agents on various types of bioluminescence are discussed elsewhere.⁸

Summary. In the firefly, ether is effective in producing a constant glow through dilation of light-organ tracheoles only in concentrations well above the minimal anesthetic tension, while a maximum effect is produced at concentrations below the lethal tension; the effect of ether on bioluminescence is thus independent of both anesthesia and death. Ether inactivates the bioluminescence reaction *in situ* only at or above lethal tensions.

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Variations in Plasma Magnesium and Potassium in Epilepsy.

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McCollum and his collaborators,^{1, 2} and also Greenberg and Tufts³ have produced hyperirritability and convulsions in rats fed on a diet deficient in magnesium. Since we have found neuromuscular twitchings and convulsions in cases of clinical hypomagnesaemia,⁴ since McQuarrie⁵ believes that in epilepsy there is a "leakage of potassium" through the cell membrane, and since Hirschfelder⁶ has

¹⁰ Shoup, C. S., *J. Gen. Physiol.*, 1929, **13**, 27; *J. Cell. Comp. Physiol.*, 1934, **5**, 269.

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¹ Kruse, H. D., Orent, E. R., and McCollum, E. V., *J. Biol. Chem.*, 1932, **96**, 519; *Am. J. Physiol.*, 1932, **101**, 454.

² Kruse, H. D., Schmidt, M. M., and McCollum, E. V., *Am. J. Physiol.*, 1933, **105**, 635.

³ Greenberg, D. M., and Tufts, E. V., *PROC. SOC. EXP. BIOL. AND MED.*, 1935, **32**, 674.

⁴ Hirschfelder, A. D. (with the technical assistance of Victor G. Haury), *PROC. SOC. EXP. BIOL. AND MED.*, 1933, **30**, 996; *J. Am. Med. Assn.*, 1934, **102**, 1138.

⁵ McQuarrie, I., *Ann. Int. Med.*, 1932, **6**, 497.

⁶ Hirschfelder, A. D., *J. Pharmacol. and Exp. Therap.*, 1929, **37**, 399.

shown that potassium salts can antagonize the narcotic action of magnesium, we have investigated the plasma magnesium and potassium in clinical epilepsy.

We determined magnesium by the method of Hirschfelder, Serles and Haury⁷† and potassium and calcium by those of Kramer and Tisdall.^{8, 9}

Total magnesium 1.7 mg. Mg or below 100 cc. plasma and ultrafiltrable Mg 0.7 or below were regarded as low; K above 30 mg. was regarded as high.

In epileptics whose plasma was collected during or just before convulsions we found the following deviations from normal: In 5 cases of status epilepticus low magnesium (1.2 to 1.7 mg.) occurred in 4, high potassium (35 to 68.5 mg.) occurred in 5, high potassium/magnesium ratio occurred in 5. In 13 epileptics with very severe convulsions, low magnesium (1.3 to 1.7 mg.) occurred in 9, high potassium (31.7 to 63.6 mg.) occurred in 6, high potassium/magnesium ratio occurred in 13. In 12 moderately severe epileptics low magnesium (1.6 to 1.7 mg.) occurred in 3, high potassium (31.6 to 52.8 mg.) occurred in 8, high potassium/magnesium ratio occurred in 11. In 5 epileptics with mild convulsions, low magnesium (1.6 to 1.7 mg.) occurred in 2, high potassium (31.7 to 40.2) occurred in 3, high potassium/magnesium ratio occurred in 4.

Low plasma magnesium and high potassium therefore are very frequent in epileptic convulsions, and a high K/Mg ratio is the most frequent deviation from the normal. The ultrafiltrable K/Mg ratio rises much more than the total K/Mg ratio. Very low magnesium (1.1 to 1.4 mg., ultrafiltrable Mg 0.4 to 0.6 mg.) or very high potassium, (45 to 69 mg.), or both, were found in patients having the most severe convulsions. The greater the severity of the convulsions the greater was the deviation from the normal. However, there is no absolute critical level at which convulsions are certain to appear.

Plasma calcium was always within normal limits.

In 17 epileptics who were not having convulsions the plasma magnesium potassium and calcium were normal.

⁷Hirschfelder, A. D., and Serles, E. R. (with the technical assistance of Victor G. Haury), *J. Biol. Chem.*, 1934, **104**, 647.

† Besides the standard solutions mentioned in our previous paper we used other proportionate dilutions of magnesium and Titan Yellow, so that the standard used for comparison corresponded more closely to the depth of color of the dye-containing diluted plasma.

⁸Kramer, B., and Tisdall, F. F., *J. Biol. Chem.*, 1921, **46**, 339.

⁹Kramer, B., and Tisdall, F. F., *J. Biol. Chem.*, 1931, **48**, 223.

Oral administration of 2 gm. magnesium chloride 4 times per day for 3 months to 10 patients did not lessen the frequency of attacks, nor did 2 gm. potassium chloride 3 times a day for 3 months to 14 other patients increase the frequency.

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Cellulase from the Slug, *Limax flavus* Linnaeus.

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Seillière¹ and Billard² and others demonstrated the presence of cellulase in *Helix pomatia* by estimating the amount of glucose produced after action of the cellulase upon suitable substrates. Boynton and Miller³ showed saccharification of wood by extracts from the ship-worm, *Bankia setacea*. Trager⁴ found a cellulase from symbiotic intestinal flagellates of termites. He estimated the amount of glucose produced, both qualitatively (by means of Benedict's reagent) and quantitatively, after action of the enzyme upon filter paper which was dissolved and precipitated.

We also made use of the fact that reducing substances (carbohydrates) were produced, as proof for the presence of slug cellulase. Two substrates were employed: (1) A finely divided suspension of cellulose was prepared by dissolving 1 gm. of Whatman's No. 40 filter paper in 100 cc. of Cross and Bevan's ZnCl₂-HCl reagent. This solution was filtered by suction through cotton and poured into about 800 cc. of distilled water. The resulting precipitate was suspended in 400 cc. of distilled water and centrifugalized. This washing process was repeated ten times and the precipitate was finally allowed to settle out. (2) The outer coverings of date seeds were removed and discarded. Filings from the inner, pearly-white endosperm were put through a 100-mesh sieve and were either suspended in distilled water or weighed in the dry state for use as a substrate.

¹ Seillière, G., *Compt. Rend. Soc. de Biol.*, 1910, **68**, 107.

² Billard, G., *Compt. Rend. Soc. de Biol.*, 1914, **76**, 566.

³ Boynton, L. C., and Miller, R. C., *J. Biol. Chem.*, 1927, **75**, 613.

⁴ Trager, W., *Biochem. J.*, 1932, **26**, 1762.