

change of erythrocytes in layers of varying thickness is in accordance with the principle of dichromatism. It is possible to construct a thin wedge of solid oxyhemoglobin and observe the thickness at which the color change occurs. In such a wedge at a thickness of 1.3μ and less the color is identical with that of a single layer of red blood corpuscles. Above 1.3μ a distinct reddish tinge is noticeable, increasing with the thickness of the wedge to a deep pure red. In this experiment the color is the same in parallel or convergent light. This rules out the influence of the stroma and the surface curvature on the color of the red blood corpuscles. Finally, small (microscopic) crystals of oxyhemoglobin (second crystallization) are of the same color as the red blood corpuscles, while larger (*i. e.*, thicker) crystals are bright red.

99 (795)

Combined action of magnesium and ether; evidence of a central effect of magnesium.

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We have shown about eight years ago that magnesium sulphate is capable of causing a profound depression in animals. After an injection of a proper dose of a solution of a magnesium salt the animal loses for some time, all reflexes and signs of sensibility, while the respiration remains intact. Several years before it was found (M.) that a condition similar to this can be produced by an intra-cerebral injection of two or three drops of a 5 per cent. solution of magnesium sulphate, while the injection of hypertonic solutions of other salts caused convulsions. On the basis of both experiences we assumed as a working hypothesis that magnesium favors an inhibition of the entire nervous system. We designated the depressed condition of the animals as anesthesia, which implied that the central nervous system was also affected. This interpretation has not been accepted by Wiki. He called attention to experiments of Binet and of his own to the effect that magnesium salts paralyze the motor nerve endings, and he assumed that in our

experiments the animals were merely paralyzed and had not lost any sensation; in short, magnesium acts, according to Wiki, like curare, although he admits the significant difference that curare paralyzes the respiratory motor nerves before the motor nerves of the other parts of the body, while magnesium paralyzes all other motor nerves before it attacks the motor nerves concerned in the respiration. The statement that magnesium paralyzes motor nerve endings is perfectly correct; we have seen it ourselves numerous times. While it is true that many other inorganic salts have also a curare-like action upon the motor nerve endings, it has to be admitted that the effect of magnesium salts upon the motor nerve endings exceeds that of any of the other salts. This fact, however, is rather in harmony with our assumption that magnesium depresses all parts of the nervous system. The question is only whether it affects also the central part of the nervous system. Wiki and two or three others deny it; we assume it, and have many good reasons for this assumption. We shall, however, not enter here upon a discussion of the entire subject. Our sole purpose in the present communication is to report the results of a series of experiments which make it probable that magnesium affects also the central nervous system. In these experiments rabbits and dogs received one half, or less, of the effective dose of magnesium sulphate. It was found that such animals are readily deeply narcotized by inhalations of small doses of ether which are insufficient to narcotize normal animals. You see here a picture of three rabbits. The dose of magnesium sulphate necessary to narcotize a rabbit is about 1.2 gm. per kilo body weight. Rabbits No. 1 and 3 each received intramuscularly 0.6 gm. $MgSO_4$ per kilo. Rabbits No. 2 and 3 inhaled through tracheotomy tubes, connected by means of a T-tube with the tube of a bottle containing ether. Each rabbit received exactly the same amount of ether which was insufficient to cause complete narcosis. The animals were photographed soon after the discontinuation of the etherization. Rabbit No. 1 which had only magnesium, and No. 2 which had only ether are sitting up. Rabbit No. 3 which had magnesium and ether is deeply narcotized and is limp. You see here a similar picture of three dogs treated in the same manner. If magnesium would have had only a peripheral effect there could

have been no summation with the subminimum central effect of the ether.

100 (796)

Note on the production of acid by tissues growing in vitro.

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Connective-tissue cells of the chicken, growing *in vitro* in chicken plasma to which a little blue litmus has been added, produce rapidly a focal, pink coloration of the medium. If a number of small fragments of one tissue (heart muscle or the aorta of young chicks, or chicken sarcoma) be plated out with the plasma medium in a petrie dish, it will be found that all the tissue bits are at first stained blue, but that those from which growth occurs become pink, while the growing tissue itself is unstained. The fragments remaining permanently inert keep the blue color.

Often a pink coloration of tissue bits can be observed at a time when growth is found, microscopically, to have barely started. The acid change is in general sharply localized to the neighborhood of the growing tissue. When growth is checked by placing the preparation in the ice-box, neutralization in the acid foci is often incomplete at the end of forty-eight hours, and this even when the bulk of alkaline plasma is relatively large and its plasma network thinned by dilution. Diffusion in the plasma medium as thus indicated is very slow. Under the ordinary circumstance of *in vitro* life without artificial provision for a circulation of fluid, tissue proliferation must take place almost from its beginning, in an acid medium. This constitutes a serious fault in the method of cultivation.

The nature of the acids produced by the growing tissue has not been determined. Carbonic and lactic acids are presumably present in greatest quantity. That the amount of acid formed may be very considerable has been shown by titrating out the as yet unclotted blue plasma to the tint acquired by the tissue cultures. The acid does not affect methyl orange, but very occasionally it changes congo red toward violet, a change best seen