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The relative toxicity of the chlorides of magnesium, calcium, potassium and sodium.

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Sodium, potassium, calcium and magnesium are normal constituents of the animal body. However, when introduced intravenously in larger quantities they may have a poisonous effect. Pharmacologists frequently speak of the effect as a salt action. This means, at least according to the definition of some pharmacological writers, that the effect is due to osmotic changes. If this were true, the toxicity of all four inorganic, basic elements ought to be the same if introduced in the same molecular concentration. Although, as far as we know, a direct comparative study of the toxicity of these inorganic substances has never yet been made, a glance at the various data in the literature suffices to show that these substances differ greatly in their toxicity. As far as we can gather, it is generally assumed that potassium is the most poisonous; calcium seems to be considered a good deal less poisonous than potassium, but definitely more so than magnesium. As to sodium, only recently Loeb and his pupils called attention to its poisonous effect.

In a series of experiments on dogs, we compared the toxicity of these four inorganic elements in intravenous injections of their chlorides. In every instance molecular solutions were employed. The toxicity of each of these salts was tested on twelve animals. The injections were made by four different methods, using three dogs for each method, namely, by injections through the jugular vein, through the femoral vein, through the splenic vein, and intra-arterially, through the central end of the carotid artery. In the latter case the solution was driven by high pressure through a capillary tube. Except in the case of sodium chloride, the solutions ran in uniformly one c.c. per minute. In order to be able to finish an experiment in one day, the solutions of sodium chloride had to be run in at the rate of two c.c. per minute. Each of the solutions was permitted to run in until the animal died.

We shall give here no details, but state the results in the briefest possible way.

The average quantity of each salt per kilo which caused death, was as follows: $MgCl_2$, 2.35 c.c.; $CaCl_2$, 4 c.c.; KCl, 6.23 c.c., and NaCl, 63.24 c.c. These figures refer to the crystalline salts when dissolved in molecular solution. When, however, these values are reduced to that of the anhydrous salts, the figures read as follows: The fatal dose of magnesium chloride is 0.223 gram per kilo (dog); of calcium chloride it is 0.444; of potassium chloride 0.464; and sodium chloride is fatal only when 3.7 grams of the salt are given per kilo. In other words, magnesium chloride is twice as toxic as calcium chloride or potassium chloride. Again, potassium chloride is about eight times more toxic than sodium chloride. In the case of the latter we have to remember that the solution ran in twice as rapidly as the solutions of the other salts, which means that the comparative toxicity of sodium chloride is even much less than appears in the above scale.

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The action of calcium upon the pupil and its relation to the effects of mydriatics.

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The intravenous injection of calcium exerts a pronounced effect upon the mechanism of pupilary constriction. The solution employed was $m/8$ $CaCl_2$; this was injected slowly through the external jugular vein of rabbits; in some instances the ear veins were used. After 12 to 14 c.c. of the solution had run in, stimulation of the cervical sympathetic nerves no longer caused dilatation of the pupil. At the same time, the pupil appeared to be smaller than normal and reacted less readily to light. When 20 to 25 c.c. had entered, the pupils, as a rule, became almost pinpoint in size. If the infusion was now stopped, the pupils remained contracted for about thirty minutes, and usually about two hours elapsed before the pupils again reached their normal size. There