of muscle. Precipitates of calcium phosphate are rapidly dissolved by acids, and would dissolve slowly in neutral calcium-free solutions. In view of these considerations I propose to devote some time to the study of the osmotic properties of calcium phosphate precipitates, as well as to those of precipitates of calcium carbonate and of magnesium phosphate and magnesium carbonate.

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The mechanical factors of excessive artificial respiration and a consideration of their relation to the acapnial theory of shock.

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It has been claimed that the most important factor in the causation of shock is diminution of CO_2 within the blood, and that this diminution is a regular consequence of all influences resulting in shock. That CO_2 possesses important physiological functions cannot be denied. An investigation therefore of the true significance of a diminution of its normal amount within the blood is important and bears a special relation to various methods of artificial respiration utilized in thoracic surgery. The present experiments were undertaken for the purpose of investigating the effects of acapnia and the relation of some factors concerned in its production to shock. In all of them dogs were used. The first series was performed for the purpose of studying the effect of variations in intrapulmonic air pressure upon the blood pressure. The thorax was opened laterally, a T-tube connected with a water manometer was tied in a small bronchus, and the heart enclosed in a Henderson cardiometer in series with a recording tambour. The blood pressure was recorded from the carotid artery. The thorax was closed and the animal was subjected to intratracheal insufflation from an apparatus provided with an exhaust valve which reduced the pressure to approximately zero about four (4) to twelve (12) times per minute. The blood pressure averaged 150 mm. Hg. when the intrapulmonic air pressure was not allowed to exceed 6 mm. Hg.

In one experiment, with an increase of intrabronchial pressure from 8 mm. to 30 mm. Hg, blood pressure fell from 122 mm. to 55 mm. Hg and the volumetric tracing indicated that the output from the heart had diminished about 44 per cent. These variations in blood pressure were completed within a few seconds after the change in intrabronchial pressure, and could be duplicated at will.

A rise of intrabronchial pressure above 8 to 10 mm. Hg always caused a fall in blood pressure, and it was concluded that the variation in pressure was the result of a diminished venous return to the heart, resulting from compression of both the pulmonary and systemic veins in the thorax.

In view of the marked changes in heart output and blood pressure resulting from small variations in intrapulmonic pressure, it is evident that, in any experiments attempting to estimate the part played in the production of shock by a diminution of CO_2 which is caused by hyperartificial respiration, the effect of the increase of intrapulmonic pressure upon the return flow of blood to the heart must be considered.

In the second series of animals, Henderson's experiments were duplicated, the dogs being artificially respired by means of a force and suction pump, working about 70 times per minute. The animals were given morphine, and ether was administered only when necessary. In these experiments, blood pressure fell about 40 per cent. within one minute after artificial respiration was begun, and then decreased more slowly throughout the experiment to between 40 and 50 mm. Hg. At the end of the experiment when the artificial respiration was stopped, blood pressure increased 60 to 90 per cent. within a few seconds. In all experiments the blood gas analysis showed the CO_2 content at the end to be only 40 to 50 per cent. of the original volume. These animals, at the end of 2 to 3 hours of artificial respiration, were all in a condition of deep shock. This degree of shock was indicated by a rapid pulse, a marked degree of coma, and insensibility to a sensory stimulation. Three of the animals so treated lived three days (dying of secondary effects of the experiment), and one lived 24 hours. None of them died from the immediate effects of the experiment. During these experiments when the artificial respiration was

temporarily stopped or permanently stopped at the end of the experiment the period of apnea lasted only one or two minutes, so that no death resulted directly from acapnia. The absence of a prolonged period of apnea is explained by the fact that the effect of ether was not added to that of morphine.

With a third series of animals, the experiments just described were duplicated with the exception that the CO_2 content of the blood was maintained at its normal level, or slightly above it. The conservation of CO_2 was accomplished by inserting a large rubber bag, to act as a reservoir, between the suction pump and the force pump, thus creating an almost perfectly closed circuit; the dog thus rebreathed expired air. To replace a small amount of air lost from the animal's trachea, CO_2 was fed from a tank into the rubber bag where the latter was diluted with air drawn in from the trachea in smaller quantities than that amount lost through this route. In these experiments the animals went into the same degree of shock in 2 or 3 hours as those of Series II in which the CO_2 content of the blood was diminished to 40 per cent. of the original volume. One animal died on the table just before the experiment closed, the others lived one to three days. Blood pressure changes in the two series were similar, but a characteristic of the experiment when the CO_2 was kept high, was the slow, strong heart beat, in place of the rapid, weak pulse observed when the CO_2 was diminished. Conclusions drawn from Series II and III can only be that the reduction in the CO_2 content of the blood is not the important factor in the production of shock by hyper-respiration, but that in the shock so produced, the essential factor is an interference with the venous return to the heart.

In the fourth series of experiments the effects of aeration and handling of the intestines were studied. A celluloid window was placed in the abdominal wall, and a stream of warm, moistened air was passed over the intestines for a period of three hours. During this procedure the animals breathed normally, the blood pressure was 163 mm. Hg, CO_2 content was normal, and there was no evidence of shock. The celluloid was then removed, the intestines spread out, and the aeration continued. After 45 minutes the CO_2 determination showed 38.8 volume per cent., and blood pressure was 153 mm. Hg. The intestines were then

handled, and in ten minutes blood pressure had fallen to 98 mm., and in 20 minutes to 56 mm. Hg. In 40 minutes there was still 31.6 vol. per cent. CO_2 in the arterial blood.

In another experiment the intestines were exposed and aerated (not handled). The CO_2 content of the blood was maintained by connecting a long tube to the trachea. After one hour and a half, blood pressure had changed but one mm. Hg and the animal was in good condition. The intestines were then handled, and in ten minutes the blood pressure fell from 122 to 60 mm. Hg. The CO_2 content was 45.1 per cent. In 25 minutes the blood pressure was 46 mm. Hg, the CO_2 content normal, and the dog in shock to such a degree that the sciatic nerve could be dissected out without the administration of ether, the animal making no movement whatever. In these experiments on the abdominal cavity the primary factor concerned is unquestionably the manipulation of the intestines, and not any diminution of CO_2 caused thereby. It will be remembered that in the similar experiments of aeration of the intestines, reported by Henderson, the intestines were "handled gently." We have been unable to find that he notes any mention of aerating the abdominal cavity beneath a celluloid membrane with air as a control experiment.

His control experiment, in which he did not secure shock, was merely aerating the abdominal cavity beneath a celluloid window placed in the abdominal wall with a stream of air plus CO_2.

The present experiment shows that aeration of the intestines without the addition of CO_2 does not produce shock.

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A note on the transmission of spirochætes.

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Leishman and other authors have shown that the anal and coxal excretions voided by ticks (*Ornithodoros moubata*), capable of transmitting spirochætes (*Spirochæta duttoni*), are infective and that susceptible animals inoculated with these fluids develop a spirochætal infection. It has been asserted that animals upon which infected ticks have fed will not become infected, unless