

quickly the cortex of the brain and the lateral columns of the cord lost their faradic excitability in severe hemorrhage. Let us remember this point in considering P. 4, P. 6, P. 7 and P. 8.

The second point to bear in mind is the severity of the stimuli in P. 2.

My conclusions are therefore as follows:

1. Lowered blood-pressure and peripheral trauma such as caused by surgical operations under anesthesia have no demonstrable effect on the Purkinje cells of the cerebellum.

2. The syndrome known as "shock" is totally unconnected with any demonstrable change in the Purkinje cells of the cerebellum.

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The influence of nocuous stimuli in the production of shock, and the failure of this influence to support the anoci theory of shock.

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The experiments reported in this communication have been performed for the purpose of investigating the influence of nocuous stimuli in the production of shock, by comparing with controls the shock-producing effect of severe and prolonged electrical stimulation to the peripheral sensory nerves in animals rendered susceptible to shock-producing influences by a reduction of their blood pressure.

Although an animal may be in severe shock with a high blood pressure, yet a fall of blood pressure always occurs before death and may be regarded as the most striking characteristic of shock. A diminution of blood pressure may, therefore, be legitimately considered to favor the development of shock, in other words, to render an animal a more sensitive test-subject upon which to investigate shock-producing influences. Such a method of experimentation would avoid the difficulty in estimating different degrees of shock in the experimental animals and would permit

the number of deaths of the animals of one series as compared to the results of the experiments of another series in which the animals were rendered slightly less sensitive to shock though subjected to precisely the same severity of stimulation, to determine the increased shock-producing effect of the electrical stimulation of their sensory nerves.

By passing a loop of thread around the inferior vena cava through a small incision in the chest wall, and sewing up the incision in such a manner that the loop of thread emerged in a straight line through the incision, a means was provided of so limiting the amount of blood returned to the heart that the arterial blood pressure could be reduced to any desired degree and for any length of time. At the conclusion of the experiment, one strand of the loop of thread was divided and the loop removed without additional operative procedure, or the danger of pneumothorax, and without any anatomical abnormality remaining.

Such a method furnished a convenient means of reducing the general blood pressure without,—it was assumed,—producing other deleterious effects on the animal than those resulting from the reduction of blood pressure alone. A number of preliminary experiments were devoted to ascertaining the level below which it was dangerous to reduce the blood pressure for a period of two hours. This level was—roughly—40 to 50 mm. of mercury. Having approximately ascertained this level, twelve experiments were performed in which the blood pressure was reduced for a period of two hours, so that the pulse pressure varied

Between 30 to 40 mm. of mercury in 8 animals,
“ 20 to 30 “ “ “ “ 3 “
“ 40 to 50 “ “ “ “ 1 animal.

Of these animals, 9 died and 3 recovered. Of the animals which recovered, the pulse pressure of 2 varied between 20 to 30 mm.; and of one, between 30 to 40 mm., for the two-hour period during which the blood pressure was mechanically reduced.

A very important fact which possesses a significance with the true nature of shock, concerns the character of the blood pressure curve after the removal of the loop around the inferior vena cava. The height to which the blood pressure rises immediately after the

release of the ligature is inversely proportional to the fall produced by the ligature. In some dogs it will return to the normal height soon after the experiment and maintain a good height for three to four hours, and then begin to progressively fall until death.

These twelve experiments, therefore, constituted the controls. With them were compared the additional effect produced by strong electrical stimulation of the peripheral sensory nerves in two other series of animals.

In one of these series, the strong electrical stimulation was applied during a period in which the animals' blood pressure was reduced to the same critical degree as in the control series and for the same length of time, *i. e.*, 2 hours. In the second series, the electrical trauma was applied during a period in which the blood pressure was reduced to a level which was considered just above the danger line, *i. e.*, 40 to 50 mm. of mercury.

The electrical stimulation was applied from an inductorium to the central end of both sciatic nerves. By an automatic arrangement, an attempt was made to eliminate block from fatigue and localization, by alternately switching the current from one nerve to the other. All experiments lasted two hours, and this period was selected because it corresponded to the usual duration of a long operation on the human being.

There were 13 experiments in which the electrical trauma was applied during a two-hour period of a low reduction of blood pressure. Of these animals, one alone recovered. In this recovered animal, the pressure varied between 20 to 30 mm.,—in other words, a very low level. Of those that died, the pulse pressure varied

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In interpreting the results of this series, some allowance must be made for the greater difficulties of the experiments in the stimulated series as compared with the controls. In the former, much more ether was necessary. Throughout the experiment, even though the animals were unconscious, it was difficult to control the struggling and there was constant hyperpnea; moreover, it

was much more difficult to confine the blood pressure to the desired level.

Comparing this series with the control series, and bearing in mind the modifying considerations which have just been mentioned, the conclusion is justified that little additional shock-producing effect was produced by the electrical stimulation of the peripheral sensory nerves. This conclusion is further strengthened by the results of the second series of stimulated animals. These animals were subjected to electrical stimulation during a period in which their blood pressure was reduced to a level which was considered safely above the critical level of the controls, namely, 40 to 50 mm. Five of these experiments were performed and all animals recovered.

In two of them the pressure was held between 40 and 50 mm. of mercury;

In one, between 40 and 60 mm. of mercury;

In two, between 50 and 70 mm. of mercury.

The results of this series still further emphasize the conclusion that the reduction of blood pressure is the all-important factor in the death of these animals, and that even in animals made very sensitive to shock-producing influences by a reduction of their blood pressure, the additional influence of trauma to the peripheral sensory nerves, as a factor in the death of the animals, is a small one.

In five other similar experiments, an attempt was made to compare the medullary reflexes at the end of the experiment with those at the beginning. In two instances, no increase of the stimulus required to elicit the cardio-inhibitory reflex from central stimulation of the vagus was necessary at the end of the experiment, as compared to the strength of the stimulus required at the beginning of the experiment. In three experiments, such a slight increase was required that it was considered negligible.