

mutational event occurring in an oogonium still undergoing mitotic division: actually there is a relatively high intraovarial identity of the mutants so far tested by inter-crossing. Besides such intraovarial identity we have also found cases of interovariarily identical lethals. However, this result needs corroboration and amplification before any specific effect of the phenol on particular loci can be postulated.

Our method is capable of wide application. Large numbers of different chemicals should be tested, and concentration, time of treatment and temperature during treatment should be varied. The success obtained with phenol encourages us to hope that new information on the chemical nature and stability of genic structures will be obtained by further work on the present lines.

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Treatment of Agonal and Clinical Death

THE study of the pathophysiology and therapy of the state of agony during experiments on animals and, in more recent years, the study of these problems in man led us to the conclusion that arteriovenous transfusions of blood with a proportion of adrenaline and glucose accompanied by vigorous artificial respiration are the most important elements in the process of resuscitation.

We may now consider it established that death of an organism does not always occur as the sudden cessation of life. The state of biological and consequently irrevocable death is usually preceded by what is now known as clinical death, diagnosed as the cessation of cardiac and respiratory activity. This period of clinical death lasts only five to six minutes, and during this period the tissues and organs have not had sufficient time to undergo changes which cannot be reversed, and in which it is therefore still possible to restore the functions of the organism. Clinical death, therefore, is merely the qualitative expression of the process of dying; in a number of cases the transition from life to death can be checked in this period.

Whatever may be the cause of agonal and clinical death, weakening of the respiratory functions and blood circulation is a major pathological process of this period, which if allowed to develop leads to death of the whole organism. The process of dying taking place in the organism that is in the agonal state or in the state of clinical death can therefore only be checked and the development of the process averted by reversing these two cardinal functions.

We felt that the data we had obtained experimentally should be used to treat wounded soldiers who were dying from wounds; accordingly we went to the Front and there in the field dressing-stations commenced work.

The major points in our methods were intended to restore the activity of the blood circulatory system by means of arteriovenous transfusions and vigorous artificial respiration with the help of bellows.

Before introducing blood into the organism, it was

heated in a bowl of hot water to 37–39° C. To the blood we added 1–2 c.c. of a 1 in 1,000 solution of adrenaline hydrochloride, and 50–100 c.c. of a 40 per cent solution of glucose. The brachial artery and vein were prepared for operation. A needle was inserted in the centripetal (with reference to heart) direction and blood was introduced at a pressure of 180–200 mm. of mercury.

As soon as there was strong contraction of the heart, blood was sent in the opposite direction, that is, transfusion was continued in the vein, this time under a pressure of 40–60 mm. Usually arterial transfusion of 200–300 c.c. of blood was sufficient to produce the necessary effect (restoration of coronary circulation). The quantity of blood introduced into the vein depended on the condition of the patient and varied from 500 c.c. to 100–200 c.c.

Artificial respiration was administered by means of bellows with a capacity of one and a half to two litres. At first, artificial respiration was given at the rate of 25–30 respirations a minute and then reduced to 16–20 a minute. The amount of air introduced at each respiration was shown on the scale of the bellows as 1,000–1,500 c.c. Artificial respiration had to be continued for some time after the appearance of natural breathing, although the rate was reduced and it was applied with intervals of rest.

A major indication for the use of this treatment is primarily sudden death from such causes as excessive loss of blood, suffocation agony and clinical death in cases of patients suffering from severe wounds to the limbs, collapse, etc. In the course of four months, we treated 51 cases of shock, agonal and pre-agonal and clinical death; there were 17 cases of bad shock, 20 cases of agony, 10 cases of clinical death and 4 cases of suffocation. In 34 cases out of 51, our treatment preceded proposed surgical operation, and thirty-one of the cases treated were able to undergo surgical treatment. The final results of our work were as follows: in 12 out of 51 cases, treatment produced a permanent effect in wounded men who had been regarded as hopeless and who were already in a state of agonal or clinical death. After resuscitation they were evacuated to hospitals in rear areas. In 37 other cases, the effect was not permanent, and wounded men died later as the result of the severe nature of their wounds. Among the cases of clinical death treated, five recovered completely all their functions. With one exception, we did not find any disturbance of the central nervous system among resuscitated men.

In view of these results, we may now consider it the task of the medical man to give active treatment for agonal and clinical death. With the cessation of cardiac and respiratory action, we cannot end our struggle for the life of the patient, especially in cases of sudden death. From this moment, the struggle becomes more intense, but not hopeless. The heart that has stopped beating can in a certain number of cases be started again, although the task is not an easy one. Respiration may also be restored, although this is even more difficult. That restoration of the functions of the whole organism follows in a certain number of cases is now an established fact. Our present task is to convert the occasional and often empirical treatment of agonal and clinical death into scientifically based and—more important—systematic therapy of these states.

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