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The spontaneous development of an acidosis condition in decerebrate cats.

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Investigations of the nature of the control of the respiratory center are rendered difficult because of the extreme susceptibility of the center to anesthetics. Much of the recent work has accordingly been done on man by methods suggested by Haldane and his pupils, and subsequently employed by Hasselbach, Linhard, R. G. Pearce and others. The obvious limitations to investigations of this type have prompted some investigators to employ decerebrate animals, or those in which the medullary centers are kept alive by artificial perfusion. The objections to the latter type of observation are too well known to require further comment here; they may or they may not be such as to render the results inapplicable to the intact animal. The chief objection to the use of decerebrate animals lies in the fact that the reactivity of the isolated centers is uncertain. This is particularly so in the case of the respiratory center. Some animals retain for several hours after the decerebration, a uniform and regular respiratory rate and volume, whilst others show an abnormal type of breathing. These irregularities, apparent in the work of Porter, Means and Newburgh, were also observed in the animals used by my former associate, R. W. Scott, in whose experiments it was further noted that apart from the animals that failed to breathe properly from the start, there were others which were apparently perfectly normal in this regard for some time (1–2 hrs.) after the decerebration, but in which later the breathing became dyspneic and irregular, and death soon followed, usually after an acute attack of vomiting.

As a preliminary to an investigation into the nature of the respiratory hormone, it was considered essential to investigate the cause of this delayed dyspnoea of decerebrate animals, not alone because these are probably the most suitable for use in such

investigations, but also because the behavior of the abnormal animal strongly suggests the possibility that development of a condition of acidosis is responsible for the symptoms. Some of the most conspicuous of the results so far obtained are reported here.

CAT. NO. XXII.

Time after Decerebration. (Min.).	Respiration per Min.		Alv.-CO_2 (Per Cent.).	Blood-CO_2 (Per Cent.).	Blood P_H.	Blood L.A. (Per Cent.).	Urine.		Rect. Temp. °C.
	c.c.	Rate.					N_{TO} Acid (Per Cent.).	NH_3 (Per Cent.).	
53	1125								
70			3.5						
73			3.6						
78	1080	28							39
93							30		
108	1225	28							
118[1]			3.3						40
133		38							
138			2.9						
148					7.4				
161		38							
171			3.0						40
178		44	1.6–1.8						
203[2]			1.7						
208				24.4	7.1	0.296	30		

CAT. NO. XXIII.

								0.107	
90							106	0.076	38.5
135	1080	27							
140			3.3						
170									
195[3]	1120	28							
210	1170	28							
215			3.3						
230	1150	30					20	0.326	
250	1120	28							
255			2.8–3.0						
285			2.9						
290	950	26							
293			2.9						
295	930	24							
302					7.6–7.7				
304				45.0		0.098	6.5		
305	960	22				0.101			

The animals (cats) were decerebrated by the method of Miller and Sherrington. In those on which regular breathing returned, an interval of one hour was allowed to elapse, so that the

[1] Suddenly hyperpnœic.

[2] Vomited.

[3] Rigidity slight.

influence of the anesthetic (ether) might have ample time to disappear, and then observations were made on the following: (1) The minute volume of air breathed; (2) the alveolar CO_2; (3) the total CO_2, P_H and (5) the lactic acid content of the arterial blood; and lastly, (6) the total acid excretion by the urine.

The general nature of the results is indicated in the following table in which the above values are given for an animal which showed no dyspnea (XXIII), and one in which this and irregular breathing were pronounced (XXII).

These experiments typify the results in extreme cases; the animal in XXIII remained in perfect condition for over five hours after the decerebration, whereas in that of XXII the breathing, although normal at the start, became later rapid and dyspneic, death, preceded by vomiting, occurring in about three and one half hours after the decerebration. Of a total of thirteen animals so far observed, six behaved like XXIII, for at least five hours, and four like XXII, while three gave intermediate results. Animals in both of the latter groups died within three hours. In the animals of the second group which provisionally we may call the acidosis group, the following changes were invariably found: (1) A progressive decrease in alveolar CO_2 followed later by (2) a decrease in blood CO_2, (3) an increase in acidity (P_H lower and (4) an increase in the lactic acid content of the blood. The excretion of acids and ammonia by the urine was irregular. The simplest interpretation of the results is that the development of a condition of acidosis is responsible for the changes observed in the dyspneic group of animals. It is further of interest to record, that decerebrate rigidity was much more pronounced in the "acidosis" animals than in those that remained normal. Whether the rigidity is responsible for the acidosis, by causing lactic acid to be discharged in excessive quantities into the blood, or whether it is an effect of the acidosis, is at present problematical.

Marked glycosuria was common in most of the animals.

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