EFFECT OF SECTIONS OF THE SPINAL CORD UPON THE EXCRETION OF CARBONIC ACID.*

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THIS subject, as far as I know, has received but little attention. When the cord has been completely divided, the action upon the pulmonary exhalation has been observed in the course of calorimetric experiments. That the gray and white material of the spinal cord have different functions is self-evident, and it is an important question in what relation they stand to the excretion of carbonic acid. It also bears upon the path of the thermo-inhibitory fibres in the spinal cord. The experiments were made upon rabbits and cats by means of Woroschiloff's instrument. The apparatus of d'Arsonval was heated to 100° F., the rectal temperature of the animal, taken just before he was placed in the chamber. The reason of maintaining the calorimeter at so high a temperature was that I wished to see the effect of a partial section of the cord upon the rectal temperature. If the ambient temperature should be much lower than that of the animal, then so much heat would be dissipated through the vaso-motor paresis that no rise of rectal temperature would be noted. It is well known that after complete section of the spinal cord and heat dissipation being prevented, a rise of temperature will be dependent upon that of the surrounding air, whether it is above or below that of the animal. Thus if the spinal cord of a rabbit be divided about the junction of the dorsal and lumbar regions, the temperature falls, but if the animal is placed

* Read before the American Neurological Association, 1884.

in a medium where the temperature of the air approaches that of the body of the animal, the temperature of the animal rises. This rise of temperature is due to the division of the cord, and not to the external heat. Thus if an uninjured animal is placed in a warm chamber for some hours, no rise of the bodily temperature takes place, but when the cord is divided and the animal placed in the warm chamber, then the temperature rises. If the spinal canal is opened completely, exposing the cord without cutting it, and the animal placed in a warm chamber, the temperature rises only a few tenths of a degree. If, on the following day, the same cord is divided, and the animal placed in a warm chamber, the temperature whilst at first falling rises several degrees. Whilst confinement in an apparatus ordinarily lowers the temperature, it is not believed that a change of it will take place where the temperature of the medium is greater than the air in which the animal usually is, and which nearly approaches that of the animal, unless it is to elevate it, and as the elevation would be the same during the successive entrances to the warm chamber, this error balances itself. The section at the junction of the cervical and dorsal regions reduces to a minimum the effect on the respiration and circulation, and probably can be overlooked in the results. To estimate the carbonic acid, the respiration apparatus of Voit was employed. It aspirated the air from the calorimeter, as it does from the usual glass case. The method of working the apparatus and the estimate of the carbonic acid were according to the plan laid down in the *Zeitschrift für Biologie*, Band xi., Heft 4.

In my several experiments upon partial division of the cord, an increase of the carbonic acid was noted in all except two. It made no difference in the majority of them whether the white or gray matter was divided. In relation to the temperature, it rose slightly above that seen after being an hour in the calorimeter, except in two ; in the others it fell below normal. The rise of temperature took place where little beyond the spinal gray was divided. In the two experiments where the decrease of carbonic acid took place, the temperature remained at the same level, or fell, whilst

in all the others the temperature and carbonic-acid excretion were increased. Appended are some of the experiments in detail.

EXP. I.

Time.	C. T.	R. T.	G. Meter.	1st Meter.	2d Meter.	3d Meter.	4th Meter.
12.55 P.M.	95.2	103¾	398,491	84.22	16.75	5.58	81.24
1.55 "	95.2	104½	403,655	85.37	17.88	6.91	82.53

Rabbit etherized. Section at the eighth dorsal vertebra. Left lateral column protected. Division of the gray matter and part of the right lateral and posterior columns. Confirmed by microscopic examination.

2.36 P.M.	95.2	100½					
3.36 "	96.	102¼	409,278	86.87	19.26	8.43	84.01

1 c. c. ō = .001 mg. CO_2.

Quantity of Air Examined.	Corrected in Litres.	Determination of Carbonic Acid. Baryta-Water. Vol. in c. c.	c. c. of Oxalic Acid for 20 c. c. Before.	After.	Carbonic Acid in the Air Examined.	Carbonic Acid in a 1,000 Litres.	
1.15	2.875	100	57.7	55.6	.01075	3.739	
		50	19.1	19.0			
1.12	2.800	100	57.7	55.	.01375	4.910	
		50	19.1	19.0			
1.33	3.325	100	19.1	18.0	.00575	1.729	
		50	19.1	19.0			
1.29	3.225	100	19.1	18.0	.00575	1.782—	2.569 per 1,000 litres of expired air of animal.
		50	19.1	19.0			
1.50	3.750	100	57.7	54.5	.01625	4.333	
		50	19.1	19.0			
1.38	3.450	100	57.7	54.0	.01875	5.434	
		50	19.1	19.0			
1.52	3.800	100	19.1	17.5	.00825	2.434	
		50	19.1	19.0			
1.48	3.700	100	19.1	17.9	.00625	1.689—	2.822 per 1,000
		50	19.1	19.0			

EXP. 2.

Time.	C. T.	R. T.	G. Meter.	1st Meter.	2d Meter.	3d Meter.	4th Meter.
12.50 P.M.	100⅘	103⅝	420,596	89.78	21.99	11.41	86.71
1.50 "		105	425,600	91.87	23.14	12.59	87.54

Rabbit. Division of gray matter, posterior columns, and part of left lateral column, divided at eighth dorsal.

2.35 P.M.	101	101	430,533	92.97	24.36	14.08	88.40
3.35 "		102½					

Quantity of Air Examined.	Corrected in Litres.	Determination of Carbonic Acid. Baryta-Water. Vol. in c. c.	c. c. of Oxalic Acid for 20 c. c. Before.	After.	Carbonic Acid in the Air Examined.	Carbonic Acid in 1,000 Litres.	
2.09	5.625	100	57.7	53.6	.02075	3.600	
		50	19.1	19.0			
1.15	2.875	100	57.7	55.9	.00925	3.200	
		50	19.1	19.0			
1.18	2.950	100	19.1	18.6	.00275	0.930	
		50	19.1	19.0			
.83	2.075	100	19.1	19.0	.00075	0.360	2.755 per 1,000
		50	19.1	19.0			
1.10	2.750	100	57.7	54.5	.01625	5.909	
		50	19.1	19.0			
1.22	3.050	100	57.7	56.0	.00875	2.868	
		50	19.1	19.0			
1.49	3.725	100	19.1	18.6	.00275	0.7382	
		50	19.1	19.0			
.86	2.150	100	19.1	19.0	.00075	0.348	3.845 per 1,000
		50	19.1	19.0			

EXP. 3.

Time.	C. T.	R. T.	G. Meter.	1st Meter.	2d Meter.	3d Meter.	4th Meter.
1.45 P.M.	98	102⅝	440,761	92.00	24.36	14.19	88.45
2.45 "	99	105¾	447,330	93.36	25.86	16.67	89.41

Cat.—Division of both lateral columns and posterior columns at 8″ dorsal vertebra.

3.00 P.M. 4.00 "	98	$102\frac{5}{8}$ $105\frac{1}{8}$	452,845	94.77	27.19	17.02	90.38

Quantity of Air Examined.	Corrected in Litres.	Determination of Carbonic Acid. Baryta-Water.			Carbonic Acid in the Air Examined.	Carbonic Acid in 1,000 Litres.	
		Vol. in c. c.	c. c. of Oxalic Acid for 20 c. c.				
			Before.	After.			
1.36	3.400	100	57.7	54.9	.01425	4.191	
		50	19.1	19.0			
1.50	3.750	100	57.7	55.4	.01175	3.133	
		50	19.1	19.0			
2.48	6.200	100	19.1	18.1	.00525	0.846	
		50	19.1	19.0			
.96	2.400	100	19.1	18.6	.00275	0.114	3.182 per 1,000
		50	19.1	19.0			
1.41	3.525	100	57.7	54.0	.01875	4.310	
		50	19.1	19.0			
1.33	3.325	100	19.1	17.9	.01625	4.887	
		50	19.1	19.0			
.35	875	100	19.1	18.1	.00625	.714	
		50	19.1	19.0			
.97	2.425	100	19.1	18.6	.00325	1.390	3.546 per 1,000
		50	19.1	19.0			