On the Reversal Effect of Adrenaline upon the Limb Vessels of the Toad.§

By

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In the hands of Yen¹⁾ the reversal action of adrenaline re the movement of rabbit intestine segment was invariably observable when the adrenaline hydrochloride solution was previously aerated with oxygen for a while, say 20 or 30 minutes, while he never came across it with the adrenaline solution not so treated.

The toad's leg vessel preparation was also experimented on by the same writer, and the normal Ringer, the summer-Ringer, the winter-Ringer and the Göthlin's solution were employed for perfusing it, but no attempt was made to aerate the adrenaline hydrochloride solution.

To supplement the previous research of Yen the present experiments were carried out with the same kind of animal and quite the same methods. Only the adipose tissue in the abdomen was not weighed. It may be superfluous to repeat all the description given in the paper of Yen.

The initial velocity of the fluid flow from the preparation made according to Laewen-Trendelenburg was usually 40-80 drops a minute, 25 and 90 a minute being rather exceptional cases. Adrenaline chloride solution of Sankyo Co. was first diluted to 1:50 with distilled water, and then strongly aerated with oxygen gas for thirty minutes. Immediately before application this solution of adrenaline was mixed with the same quantity of the double nutrition fluid, and then diluted further with the

§) Presented before the Annual Meeting of the Japanese Physiological at Osaka, April 1930.

1) Yen, Tohoku J. Exp. Med., 1930, 14, 415. A rather complete review re the reversal effect of adrenaline is given there.

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Bufo jap. ♀ 260 grms., weight of limbs 110 grms., weight increase (oedema) 10 grms.

Perfused with the new fluid of nutrition. R. T. 25-26°C.

9:25 a.m. Perfusion began; pressure 10 ccms. 10:10 a.m. Counting began.

Time from beginning of counting (hr.: mins.)	Drop number per minute	Amount & concentration of introduced adrenaline solution	Time from beginning of counting (hrs.: mins.)	Drop number per minute	Amount & concentration of introduced adrenaline solution
: 4	46		1: 06	43	
: 7	45		1: 08	41	
: 10	45	{ 0.1 c.c. 1: 1 milliard	1: 10	38	{ 0.2 c.c. 1: 100 millions
: 11	48	{ aerated adrenaline	1: 11	39	{ control adrenaline
: 13	46		1: 15	37	{ 0.3 c.c. 1: 100 millions
: 15	45	{ 0.2 c.c. 1: 1 milliard	1: 16	40	{ aerated adrenaline
: 16	49	{ aerated adrenaline	1: 18	40	
: 17	47		1: 20	38	{ 0.3 c.c. 1: 100 millions
: 20	44	{ 0.2 c.c. 1: 1 milliard	1: 21	37	{ control adrenaline
: 21	45	{ control adrenaline	1: 23	39	
: 23	44		1: 30	37	{ 0.1 c.c. 1: 10 millions
: 25	43	{ 0.3 c.c. 1: 1 milliard	1: 31	40	{ aerated adrenaline
: 26	47	{ aerated adrenaline	1: 33	41	
: 28	45		1: 35	38	{ 0.2 c.c. 1: 10 millions
: 30	42	{ 0.3 c.c. 1: 1 milliard	1: 36	42	{ aerated adrenaline
: 31	43	{ control adrenaline	1: 38	41	
: 35	42	{ 0.1 c.c. 1: 100 millions	1: 40	37	{ 0.2 c.c. 1: 10 millions
: 36	45	{ aerated adrenaline	1: 41	37	{ control adrenaline
: 38	44		1: 43	35	
: 40	42	{ 0.2 c.c. 1: 100 millions	1: 45	35	{ 0.3 c.c. 1: 10 millions
: 41	46	{ aerated adrenaline	1: 46	37	{ aerated adrenaline
: 43	44		1: 48	36	
: 45	42	{ 0.2 c.c. 1: 100 millions	1: 50	34	{ 0.3 c.c. 1: 10 millions
: 46	43	{ control adrenaline	1: 51	33	{ control adrenaline
: 48	41		1: 53	33	
: 50	41	{ 0.3 c.c. 1: 100 millions	2: 00	33	{ 0.1 c.c. 1: 1 million
: 51	44	{ aerated adrenaline	2: 01	34	{ aerated adrenaline
: 53	40		2: 03	32	
: 55	39	{ 0.3 c.c. 1: 100 millions	2: 05	32	{ 0.2 c.c. 1: 1 million
: 56	39	{ control adrenaline	2: 06	33	{ aerated adrenaline
: 58	37		2: 08	31	
1: 00	40	{ 0.1 c.c. 1: 100 millions	2: 10	30	{ 0.2 c.c. 1: 1 million
1: 01	41	{ aerated adrenaline	2: 11	28	{ control adrenaline
1: 03	43		2: 13	27	
1: 05	39	{ 0.2 c.c. 1: 100 millions	2: 15	26	
		{ aerated adrenaline			

nutrition fluid to a given concentration. As the control the adrenaline chloride solution, not aerated, was used.

Five preparations were perfused with the normal Ringer (NaCl 0.6 grm., KCl 0.0075 grm., CaCl₂ 0.01 grm., NaHCO₃ 0.01 grm., water to 100 c.c.), and 0.1 c.c., 0.2 c.c., 0.3 c.c. and 0.4 c.c. of the adrenaline hydrochloride solutions with the concentration as 1: 100 milliards, 1: 10 milliards,

1 : 1 milliard, 1 : 100 millions and 1 : 10 millions, which were strongly aerated with oxygen for thirty minutes, were injected, whereby no increase occurred in the drop number, that is, the reversal action of adrenaline was never discovered although the aerated adrenaline solution was applied

A nutrition fluid, somewhat differing from the normal Ringer, *rè* the ion concentration of calcium and potassium, and in fact with the composition as NaCl 0.65 grm., KCl 0.03 grm., CaCl₂ 0.0065 grm., NaHCO₃ 0.01 grm., water to 100 c.c., was then introduced ; it was applied to ten preparations and this time the aerated adrenaline hydrochloride solution yielded in every case an increase in the drop number, viz. vasodilation, contrary to the non-aerated adrenaline solution. The accompanying protocol is given as an example. 0.1 to 0.4 c.c. of the fluids made from the aerated adrenaline solution in 1 : 1 milliard, 1 : 100 millions, 1 : 10 millions strength always yielded an increase in the drop number, as 2 to 4 drops a minute, whereas the same amount of the same strength of the solution but made from the non-aerated adrenaline failed to do so, and moreover the 1 : 1 million solution occasioned on the contrary a decrease in the drop number.

The present experiments thus show the appearance of the reversal effect of adrenaline on the toad limb vessels if the adrenaline is aerated with oxygen sufficiently, and at the same time the vessels are perfused with the fluid containing an excess of potassium and a minor amount of calcium compared with the normal Ringer fluid. If a perfusion fluid with such composition be employed, the reversal effect is not obtainable unless the adrenaline is aerated.