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The relation of pulse pressure to stroke volume.

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In 1904 Erlanger and Hooker[1] suggested that the product of the pulse pressure (P. P.) and the pulse rate (P. R.) might be used as an index to the circulation rate (C. R.), or, expressed differently, the pulse pressure as an index to the stroke volume (S. V.), provided changes in systolic time and elasticity of the arteries do not disturb too much the direct relation of the P. P. to S. V.

In order to ascertain what the relation is, four normal individuals were studied under four relatively normal conditions. The conditions studied were the recumbent and standing postures and light and post-heavy exercise. Arterial pressure determinations could not be made during heavy exercise; therefore, they were made immediately afterwards.

The arterial pressure readings were made simultaneously by the oscillatory (Erlanger) and the auscultatory methods. The circulation rate in liters per minute was determined by the Henderson and Haggard[2] method, involving the inhalation of ethyl iodide. Ten arterial pressure determinations were made to each observation of the circulation rate and the average of these are used as a basis of comparison.

When the S. V. is plotted against the P. P. it is found that a straight line passing through the points indicating the mean values for standing and light exercise almost, if not quite, passes through zero and also the mean of heavy exercise, indicating that the relationship between these is one of direct proportionality. On the other hand the mean of the recumbent observation always falls to the left of this line. The recumbent pulse rate and diastolic pressure are in each case decidedly lower than in the other states. The longer systolic time of the slower P. R. and the re-

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1 Erlanger, J., and Hooker, D. R., *The Johns Hopkins Hospital Reports*, 1904, xii, 147.

2 Henderson, Y., and Haggard, H. W., *Am. J. Physiol.*, 1925, lxxiii, 193.

Subject		Averages						
		P. R.	D. P.	P. P.	S. V.	*S. V.* / P. P.	P. P. × P. R.	C. R.
T. H.	Recumbent	72.1	72.5	45.3	82	1.79	3279	5.85
	Standing	95.5	86.9	25.3	39.5	1.56	2471	3.72
	Lt. Exercise	108	79.3	46.6	78	1.66	5063	8.4
	Post-Hvy Ex.	131	86	73	131	1.83	9882	16.7
W. D.	Recumbent	64.6	62.2	45.6	108	2.42	2889	7.06
	Standing	82.8	71.8	33	58	1.77	2716	4.78
	Lt. Exercise	84.5	63	53	96	1.805	4313	8.1
	Post-Hvy Ex.	128	64	85	146	1.72	10090	18.7
E. E.	Recumbent	64.5	86	43.5	86	1.97	2785	5.5
	Standing	93.5	88.5	33.2	46	1.38	3108	4.32
	Lt. Exercise	88	92.5	48	76	1.58	4235	6.7
	Post-Hvy Ex.	93	87	64	103	1.58	5820	9.65
D. W.	Recumbent	69	72	40.5	105	2.59	2795	7.25
	Standing	100	73.5	35	48	1.37	3523	4.8
	Lt. Exercise	103.5	72	57.5	93	1.62	5960	9.7
	Post-Hvy Ex.	117	71	85	129	1.51	10025	15.1

duced coefficient of elasticity associated with the lower diastolic pressure both would have the effect of reducing the P. P. produced by a given stroke volume, and both would, therefore, tend to put the mean of the recumbent reading to the left of the line passing through the mean standing and exercise readings.

The scattering of the points and the fact that the lines drawn through the mean of the standing and exercise determinations do not pass through zero must be attributed to the influence of systolic time and arterial elasticity upon the relation to P. P. to S. V. It so happens that these modifying factors do not, in our observations, materially obscure the linear relationship of P. P. to S. V. The scattering of the points around their respective means is in part explained by experimental error, and in part again by the influence of systolic time and arterial elasticity. Thus the determinations in which the pulse rate is relatively rapid all tend to fall to right of the line.

Obviously when the product P. P. $\times$ P. R. is used as an index to the C. R. the modifying influence of the systolic time on the relation of P. P. to S. V. will have to be taken into consideration. In every case save two, the means of the P. P. $\times$ P. R. and of the C. R. change in the same direction. The two exceptions occur in the change from the recumbent to the standing posture and in these two cases the pulse has the largest rate.

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The action of adrenalin on the pyloric sphincter.

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Because of the lack of consistent data bearing on the action of adrenalin on the pyloric sphincter, a further investigation of the problem has been undertaken. The results so far obtained have been sufficiently constant that a preliminary report, indicating their general character, seems justified. The investigation has been confined to a study of the immediate effects of the drug administered intravenously to anesthetized dogs. Several methods