

73 (1005)

The blood ptosis test and its use in experimental work in hygiene.**By C. WARD CRAMPTON.**

[From the Department of Education, New York City, Bureau of Educational Hygiene.]

The modern health campaign has three parts.

1. The cure of disease,
2. The direct prevention of disease by sanitation, quarantine, instruction in hygiene, and the like, and
3. Euthenics.

This last includes physical training, play, and all measures calculated to increase resistance to disease and bodily efficiency.

The success of health and vitality increasing measures is difficult to estimate on account of the lack of tests. It is possible to measure the result of long-continued activities such as physical training, gymnastics, play, athletics, and good ventilation on the one hand, and fatigue-producing activities, such as school life of various kinds, on the other hand, by noting the increase or decrease of incidence of disease, and absence from school, and the percentage of hemoglobin, etc. These tests are difficult to control because they take a long time, and other factors cannot always be successfully eliminated or controlled. It is highly desirable to obtain some test of some important body function which will show clearly and rapidly by its variations, the beneficial or depressive effect of various conditions supposed to affect health. Such a test will be useful in proportion to the importance of the function tested and its accuracy in recording the variations of this function.

The following test promises to fulfill these conditions. It is well known that the splanchnic veins are very capacious, and if vaso-tone is relaxed, they fill at the expense of the rest of the body. The vaso control of the splanchnic area is in man, comparatively recently adjusted to the erect position. As such, it is easily wearied and easily damaged by unhygienic influences which decrease the efficiency of the sympathetic nervous system. The efficiency of this control is, I believe, measured by placing the

subject in a horizontal position and taking the systolic pressure in the brachial artery. The subject is then required to stand, and without removing the cuff, blood pressure is taken in a vertical position. In a perfectly strong and vigorous subject the splanchnic vaso-tone will increase and the blood pressure will be found raised about 10 millimeters of mercury. In an individual weakened by dissipation, overwork, lack of sleep, or by the incidence of disease, the blood pressure will tend not to rise but to fall. Under conditions which may still be classed as normal, this fall of pressure may amount to ten millimeters. These facts have been verified by repeated tests upon those known to be in good and in bad condition, in subjects well rested, and others thoroughly wearied. It appeared, therefore, at this point in the investigation, that we have arrived at a test of an important function and that the test could be expressed numerically on a scale ranging from plus ten to minus ten. A further factor of importance was, however, present. It was found in the vigorous subjects that the heart rate did not increase on standing, and in the wearied subjects it increases as much as forty-four beats per minute. It was further found that this difference varied with the blood pressure differences and in some cases took the place of the blood pressure variation. In other words, the same subject under the same conditions would show a weakness sometimes by a decrease in blood pressure, and at other times by an increase in heart rate, and vice versa. After further observation, it was determined that a decrease of one millimeter of mercury had a value of an increase in heart rate of approximately two. It was obviously necessary to consider both elements and to adjust the heart-rate changes with the corresponding blood-pressure changes. To do this, it was assumed that the total observed ranges in heart rate and blood pressure were equal in total value, and equal in each step in the scale in a proportion to approximately two to one. A table which balanced these two elements was constructed as shown on page 121.

The 100 per cent. rating indicates a rise of ten in pressure with practically no increase in the heart rate. Throughout the table, an inefficiency exhibited either in blood pressure or in heart rate is given a corresponding lower rating until zero is reached. The

zero point indicates approximately the condition in which the vaso-tone system is working so poorly that the subject cannot maintain an erect position. This test has been used by many observers to determine the condition of athletes and has been verified by putting the athlete through a test in running, etc., to check up the findings of the test. The results have as a rule verified the observed percentages. This test forms part of the

PERCENTAGE SCALE.

VASOMOTOR TONE.

Blood Pressure.

Heart Rate Increase.	Increase.					0	Decrease.				
	+10	+8	+6	+4	+2		-2	-4	-6	-8	-10
0 to 4	100	95	90	85	80	75	70	65	60	55	50
5 to 8	95	90	85	80	75	70	65	60	55	50	45
9 to 12	90	85	80	75	70	65	60	55	50	45	40
13 to 16	85	80	75	70	65	60	55	50	45	40	35
17 to 20	80	75	70	65	60	55	50	45	40	35	30
21 to 24	75	70	65	60	55	50	45	40	35	30	25
25 to 28	70	65	60	55	50	45	40	35	30	25	20
29 to 32	65	60	55	50	45	40	35	30	25	20	15
33 to 36	60	55	50	45	40	35	30	25	20	15	10
37 to 40	55	50	45	40	35	30	25	20	15	10	5
41 to 44	50	45	40	35	30	25	20	15	10	5	0

Note: In case of increase in pressure higher than +10 add 5 per cent. to the +10 column for each 2 millimeters in excess of 10.

routine examination in many colleges where athletes are examined by the physical director previous to certification of physical fitness. In five cases with five different observers, an athlete has presented himself for certification claiming to be in perfect condition and pointing to previous successful performances. In these cases the vaso-tone percentage was found very low and the candidate was referred for another examination on the next day. In these cases the candidates did not appear and were found to be ill. Thus it appeared that the test revealed a damaged vaso-tone, before subjective or objective symptoms were apparent. This test has been used to catalogue the effect of various school tasks upon the splanchnic vaso-tone. This test is being used by the New York State Commission on Ventilation to determine the effect of high and low temperature and humidities. In a pre-

liminary report, it was found that vaso-tone efficiency was 50 per cent. greater at 68° than at 86°. It is believed that this test will measure with reasonable accuracy the efficiency of the splanchnic vaso-tone and that this is an important indication of the efficiency of a body and related closely to vitality. It is realized that the test does not measure other important factors of physical and mental efficiency, and will not, for instance, reveal the structural condition of the heart. It does, however, open a new field for the measurement of the results of work calculated to improve physical condition.

74 (1006)

On the preservation in vitro of living erythrocytes.

By PEYTON ROUS, M.D. and J. R. TURNER, M.D.

[From the Laboratories of the Rockefeller Institute for Medical Research.]

The length of life of the functioning red blood cell is not known, but there is indirect evidence that it is several weeks at least. *A priori* one might suppose that if these elements were kept in the cold outside the body their period of survival would be much longer. But as a matter of fact in citrated plasma or defibrinated blood the erythrocytes of many species begin to break down within a week or ten days; and washed erythrocytes in normal salt solution or Ringer's fluid do not last even so long.

In previous papers we have shown that the early hemolysis of washed erythrocytes is attributable in large part to injury during washing; and that this injury can be prevented by the presence of a very little gelatin in the wash fluid (1/8th of 1 per cent.). But even when protected during washing the erythrocytes do not remain intact *in vitro* nearly so long as they are supposed to in the circulation. We have addressed ourselves to the problem of their preservation.

For reasons which need not here be entered into, our first experiments were made with solutions of inorganic salts to which non-protein colloids were added. But it was found that though gelatin will protect red cells against injury during washing it has