fragment). Even after removal of the adrenal remnant typical reactions were obtained.

We must accordingly conclude that Anrep's experiments do not constitute a proof that the epinephrin output is reflexly increased by stimulation of the central end of the sciatic.

Stimulation of the splanchnic, with either the corresponding or both adrenals eliminated, frequently gave good reactions. We do not doubt, however, that since splanchnic stimulation is known to increase the epinephrin output, such increase with direct stimulation of the peripheral secretory nerves, when the adrenals are intact, can be a factor in the reaction as obtained in this way.

13 (1973)

Lasting individual differences in the resistance of normal bloods to shaking.

By OSWALD H. ROBERTSON and PEYTON ROUS

[*From the Rockefeller Institute, New York City*]

In previous papers observations have been recorded which indicate that the normal destruction of red cells is accomplished, in part at least, by a fragmentation of the elements while circulating[1]. It has seemed possible that the behavior of cells shaken in *vitro* may yield some indication of their resistance to the fragmenting process.

Marked differences in the red cells from different species have already been disclosed by the shaking method[2]. Further observations have now been made. Shaking which suffices to liberate 10-25 per cent. of the hemoglobin contained in a suspension of washed cells of the rat brings out only 4 per cent. of the pigment from an average specimen of rabbit cells, 1 per cent. from monkey blood, and a mere trace from human blood. Dog corpuscles are among the most labile, as many investigators can attest who have striven to obtain plasma untinted by hemolysis.

The variation in the resistance of individual bloods of a single species, the rabbit for example, are by no means inconsiderable.

[1] Rous, Peyton, and Robertson, O. H., *Jour. Exper. Med.*, 1917, xxv, 651.

[2] Rous, Peyton, and Turner, J. R., *Jour. Exper. Med.*, 1916, xxiii, 219 and 239.

The method of washing and shaking the cells has already been described. Healthy adult animals with bloods showing the same general ratio of hemoglobin to corpuscle bulk were employed. The amount of hemoglobin set free was read off as acid hematin by comparison with a standard series of tubes containing graded solutions of the substance. In one experiment washed specimens from 20 rabbits, shaken at the same time, yielded from 1.2 per cent. to 5.4 per cent. of their hemoglobin; in another set of 27 individuals, 0.8 per cent. to 5.7 per cent. was set free. The range of resistance here exhibited was in striking contrast to the uniformity of the response to a specific hemolysin in graded dilution. The resistance to hypotonic salt solution, while much less uniform than this latter, was still not so frequently variable as that to shaking, though occasional instances of marked individual susceptibility were encountered. Generally speaking, resistance to the one means of cell injury yielded no indication of that to the other.

The individual blood differences disclosed by the shaking method persisted throughout the period of our observations (43 days). They were independent of sex, weight, normal variations in bone-marrow activity as indicated by the percentage of circulating reticulocytes, and of moderate intercurrent changes in the hemoglobin percentage and in the number of red cells per cu. mm. of blood. They did not tally with the individual variations in the rate of breaking down of artificial subcutaneous extravasates. The spleens of the individuals with fragile cells proved to be no larger, and erythro-phagocytosis was no more marked than in the animals with resistant cells. The organs of all were normal.

It would be difficult to employ the resistance of the blood to shaking as a clinical test. Pathological variations in the pigment-stroma ratio, and in corpuscle size are among the more serious complicating obstacles.