ESTERASE ACTIVITY OF THE BLOOD OF VARIOUS ANIMAL SPECIES

V. A. Filov

Laboratory of Toxicology (Head, Professor I. D. Gadaskina), Institute of Industrial Health and Occupational Diseases, Leningrad
(Presented by Active Member AMN SSSR S. E. Severin)
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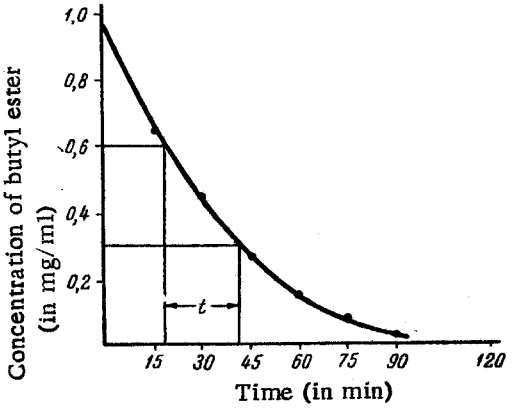
We have investigated the esterase activity of the blood of 12 animal species by measuring the decomposition of butyl acetate.

Blood was taken from the animal and placed in a 25 ml bottle fitted with a ground-glass stopper; butyl acetate in physiological saline was then added. The proportion was kept constant at 8 parts of blood to 5 parts of ester solution. When working with the small animals (frogs and white mice) we had to combine the bloods of 2-4 specimens. The contents of the bottle were mixed and placed in a thermostat at 37°. At intervals 1 ml was removed for quantitative estimation of the butyl acetate. Hestrin's method [2] was used for the determination. The initial concentration of the butyl ester in the mixture ranged from 0.7 to 2 mg/ml.

The relationship found: $C = f(t)$, where C is the concentration of butyl acetate at a time t shows a decrement, and the shape of the graph obtained is similar to that describing a first-order process. This result agrees with the concept of the biological hydrolysis of complex esters as taking place in a reaction of the first-order [1]. We calculated the velocity constant of the processes of the first-order corresponding to our experimental results. For this purpose all experimental results were expressed graphically (see Figure). For the sake of uniformity the initial concentration was set at 0.6 mg/ml, and from the graph we determined the time t required to reduce the concentration of the butyl ester to one half, i.e., to 0.3 mg/ml. The velocity constant was then found to be $0.693/t$, where t was determined graphically for each experiment.

We carried out 2-4 experiments with the blood of each animal. To obtain a clearer picture of the variation between one individual and another within the species we first carried out nine experiments with rabbit blood. The following velocity constants were obtained: 0.055, 0.053, 0.050, 0.050, 0.045, 0.040, 0.038, 0.034, and 0.028.



Rate of breakdown of butyl acetate from human blood. Experiment No. 32. K = 0.030.

From these experiments it can be seen that the individual variation within the species is considerable. The extreme values of the velocity constant are 0.055 and 0.028, i.e., a difference of 2 times.

The results obtained for the other 11 species are given in the Table; the species are arranged in ascending order of velocity constant.

The results indicate that the blood esterase activity of the different species varies over a wide range. The intraspecies variation is far greater than the variation within the species.

In general the blood of the small animals was the most active, a result which may be attributed to the greater intensity of the metabolic processes. However this relationship is not rigid. For example cow blood is more active than that of the pig, sheep, or dog; the blood of the

Velocity Constants for the Breakdown of Butyl Acetate in the Blood of Various Animals and of Man

Material	Constant			
Blood of dog	0,010	0,016		
Blood of sheep	0,014	0,014	0,015	
Blood of pig	0,017	0,018		
Blood of frog	0,020	0,022	0,028	
Blood of cow	0,024	0,028		
Blood of man	0,025	0,025	0,030	
Blood of cat	0,029	0,030	0,036	
Blood of white mouse	0,068	0,070	0,073	
Blood of white rat	0,050	0,063	0,081	
Blood of pigeon	0,07	0,08	0,10	0,14
Blood of guinea pig	0,20	0,23	0,28	0,28

pigeon is more active than that of white mice, and the same is true to a greater degree of the guinea pig; the frog is grouped with the cow and pig as having a comparatively inactive blood.

SUMMARY

The esterase activity of the blood of 12 different species of animal was investigated in terms of its ability to decompose butyl acetate. The results are expressed in forms of velocity constant of the reaction. The esterase activity of the blood was not constant. It varied within the species over the comparatively narrow range of 2:1. In the different species it varied by scores of times.

LITERATURE CITED

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2. S. Hestrin, J. biol. Chem., 1949, Vol. 180, p. 249.