

# ROLE OF ALKALINE PHOSPHATASE OF THE NEUTROPHILS FOR THEIR PHAGOCYTOTIC FUNCTION

E. A. Venglinskaya and M. G. Shubich

UDC 612.112.3:612.112.91.015.14

Experiments on rabbits showed that the digestive power of the leukocytes is closely connected with changes in intracellular alkaline phosphatase activity. Neutrophils with high enzyme activity possess the greatest phagocytic activity. During digestion the intracellular enzyme activity falls, possibly as a result of utilization of the enzyme during incorporation into phagosomes. The enzyme activity was unchanged in control experiments. It is concluded that alkaline phosphatase is one of the essential factors determining the protective function of neutrophils.

The link between alkaline phosphatase (AP) activity of neutrophil (pseudo-eosinophil) leukocytes and their phagocytic function is not adequately reflected in the literature [4].

The present investigation was undertaken to study changes in AP activity of the neutrophils in connection with their phagocytic activity.

## EXPERIMENTAL

Experiments were carried out on 30 rabbits. Blood for cytochemical study of AP activity and determination of phagocytic activity relative to *Escherichia coli* (Strain K 12 S) was taken from the marginal vein of the ear. The degree of completion of phagocytosis was determined by the method of Berman and Slavskaya [1], and the digestive capacity of the leukocytes was expressed as the index of completion [3]; AP activity was detected by the azo-coupling reaction [5] and the index of phosphatase activity of the neutrophils (IPAN) was calculated by Kaplow's method [8]. In control tests AP activity was determined without addition of the bacteria.

## EXPERIMENTAL RESULTS

The results are given in Table 1.

Exposure of the leukocytes on agar for 1 h had no effect on their AP activity. In the initial phase of phagocytosis a tendency for the enzyme activity to fall was observed. During phagocytosis, as the disintegration and fragmentation of the bacteria progressed and the index of completion rose, the value of IPAN fell significantly. A similar pattern was observed on statistical analysis of the data by the method of non-parametric analysis ( $P < 0.01$ ).

Correlation analysis [2, 6] showed that the digestive power of the neutrophils is closely connected with their phosphatase activity ( $P < 0.01$ ). The character of the relationship differs in different stages of phagocytosis (Table 1).

A study of the impressions showed that the distribution of neutrophils with different levels of AP activity changed during phagocytosis on account of an increase in the number of cells showing no evidence of AP activity and a decrease in the number of cells with high AP activity ( $P < 0.001$ ). Attraction of the bacteria took place mainly around neutrophils with high AP activity. Nonviable bacteria were usually found in leukocytes with low enzyme activity or none, and less frequently around those with high activity.

---

Kuban Medical Institute. (Presented by Academician of the Academy of Medical Sciences of the USSR N. N. Zhukov-Verezhnikov.) Translated from *Byulleten' Éksperimental'noi Biologii i Meditsiny*, Vol. 74, No. 11, pp. 61-62, November, 1972. Original article submitted December 14, 1971.

© 1973 Consultants Bureau, a division of Plenum Publishing Corporation, 227 West 17th Street, New York, N. Y. 10011. All rights reserved. This article cannot be reproduced for any purpose whatsoever without permission of the publisher. A copy of this article is available from the publisher for \$15.00.

TABLE 1. Phagocytic and Enzymic Activity of Rabbit Blood Neutrophils

Statistical index	IPAN				Index of completion of phagocytosis	
	control		expt.		expt'l. impressions	
	a	b	a	b	a	b
$M$	206	206	195	161	0,20	0,50
$\pm m$	7,0	5,0	5,5	7,5	0,02	0,03
$P$				$<0,001$		$<0,001$
$P_1$			$>0,05$	$<0,01$		
$r$					+0,41	-0,51
$\pm m_r$					0,17	0,16
$P$					$<0,02$	$<0,01$

Legend. a) Before exposure; b) after exposure for 1 h on agar.

Note: P) Relative to impressions taken at once;  $P_1$ ) relative to control.

It can be concluded from these results that the leukocytes with high AP activity are the most active phagocytes. In the course of digestion of the bacteria the intracellular enzyme activity falls, probably as a result of utilization of the enzyme during incorporation into phagosomes [7]. This indicates that AP is one of the factors responsible for the protective function of neutrophil leukocytes.

#### LITERATURE CITED

1. B. M. Berman and E. I. Slavskaya, Zh. Mikrobiol., No. 3, 8 (1958).
2. B. S. Bessmertnyi, Statistical Analysis in Clinical, Preventive, and Experimental Medicine [in Russian], Moscow (1967).
3. L. Z. Klechikov, Lab. Delo, No. 3, 157 (1967).
4. B. S. Nagoev, N. B. Primachenko, and M. G. Shubich, Zh. Mikrobiol., No. 6, 146 (1969).
5. M. G. Shubich, Lab. Delo, No. 1, 10 (1965).
6. D. Sepetliev, Statistical Methods in Scientific Medical Research [in Russian], Moscow (1968).
7. R. Horn, S. Spicer, and B. Wetzel, Am. J. Path., 45, 327 (1964).
8. L. Kaplow, Blood, 10, 1023 (1955).