

INTRAPOPOPULATIONAL HETEROGENEITY OF HUMAN  
NEUTROPHILS FOR CHEMOKINESIS AND RESPIRATORY BURST  
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The neutrophil is capable of reacting in many different ways, and this endows it with high plasticity and rich effector possibilities. It is capable of active and purposive movement, ingestion, adhesion, secretion of preformed and newly formed cytotoxicity mediators, intercellular cooperation, etc. [3]. The same stimulus can induce all or most reactions of neutrophils, but this is the exception rather than the rule. There is increasing evidence that individual manifestations of neutrophil reactivity are determined by independent mechanisms and may be observed independently of each other. Genetic defects and experimental situations are known when one or more of the functions listed above is lost but ability to give the other reactions is preserved [6, 7, 10, 11].

This paper describes data on the ability of neutrophils to respond by two types of reactions simultaneously: intensification of chemokinesis and oxygen-dependent metabolism — the key element of the cytotoxic powers of phagocytic cells [8].

## EXPERIMENTAL METHOD

Tests were carried out on 25 healthy blood donors aged 20–40 years. Neutrophils were stimulated *in vitro* by the addition of *Staphylococcus aureus* allergen (produced by Kazan' Research Institute of Immunology, Epidemiology, and Microbiology, Ministry of Health of the RSFSR). Staphylococcal allergen (250 µg/ml) and 25% sodium citrate solution were mixed in the ratio of 4:1 in a siliconized test tube. To 0.02 ml of the mixture 0.08 ml of capillary blood was added and the sample was incubated for 90 min at 37°C, 0.05 ml of 0.2% nitro-BT solution was added, and incubation continued for a further 30 min. Films were stained for glycogen [5] and the nuclei were counterstained with 0.1% methyl green. The intensity of chemokinesis was determined by recording ameboid evaginations of the neutrophils with redistribution of glycogen [4]. Activity of acid-dependent metabolism (respiratory burst) was judged by intracellular deposition of diformazan — the reduced form of nitro-BT [2]. Altogether 100 neutrophils were analyzed, counting unstimulated (intact) and stimulated (ameboidlike and diformazan-containing) cells.

## EXPERIMENTAL RESULTS

Unstimulated neutrophils accounted for 22–96% ( $71.6 \pm 4.1\%$ ) in different experiments (Table 1). Three variants were distinguished among the stimulated cells: 1) neutrophils developing only ameboid motility, 2) neutrophils with activation of acid-dependent metabolism, and 3) neutrophils giving positive results for both tests. The content of the three above-mentioned variants of stimulated cells differed in different donors: variant 1 from 1 to 32% ( $13.5 \pm 1.7\%$ ), variant 2 from 0 to 52% ( $11.5 \pm 0.6\%$ ), and variant 3 from 0 to 19% ( $2.6 \pm 0.8\%$ ).

The neutrophils thus differed in their ability to realize these two effector functions: motor and respiratory. Over 20% of the neutrophils gave only one type of response: activation of chemokinesis or activation of oxygen-dependent metabolism. This confirms the view that the neutrophil is a polyfunctional aggregate, which utilizes its resources differentially depending on the character and conditions of stimulation [3]. The different character of response of individual cells, described in this paper, suggests heterogeneity of the blood neutrophils. This concept, which was put forward a long time ago on the basis of "age maturity" of neutrophils [1], has recently developed beyond the bounds of the concept of physiological heterogeneity of the cells. The view has evolved that

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TABLE 1. Activity of Chemokinesis and Oxygen-Dependent Metabolism of Human Neutrophils Stimulated by Staphylococcus aureus Allergen

Donor	Unstimulated neutrophils (Ck-, Om+)	Variants of stimulated neutrophils		
		Ck+ Om+	Ck+ Om-	Ck- Om+
1	22	19	7	52
2	76	0	10	14
3	71	3	16	10
4	70	0	20	10
5	63	2	30	5
6	66	2	16	16
7	67	5	10	18
8	69	1	17	13
9	62	6	5	27
10	72	1	21	6
11	68	4	22	6
12	87	0	10	3
13	66	8	16	10
14	67	2	30	1
15	90	3	7	0
16	64	0	32	4
17	70	0	1	29
18	72	1	8	19
19	80	0	19	1
20	73	3	13	11
21	71	3	16	10
22	96	0	3	1
23	90	0	6	4
24	88	0	11	1
25	71	4	7	18
<i>M±m</i>	71,6±4,1	2,6±0,8	13,5±1,7	11,5±0,6

Legend. Ck) Chemokinesis (ameboid activity of cells), Om) intensification of oxygen-dependent metabolism (reduction of nitro-BT).

true subpopulations of peripheral neutrophils, differing in certain functional features, exist [9]. Our observations confirm this view. Within the same population we observed at least four variants of cells which responded differently to the same stimulus. Considering that neutrophils from different donors differ in their reactivity profile, it can be postulated that the functional reserve of the phagocytosis system exhibits individual differences.

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