

THE IMMUNE SYSTEM AS A TARGET OF PHYSICAL EFFORT AND PSYCHOLOGICAL STRESS

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Detailed review and analysis of immune parameters in the course of physical effort is based on highly specialized immunological data which are usually difficult to understand for non immunologist. We decided to introduce schematically outlined elements of immune system physiology to enable for non specialists precisely follow our discussion. The immune system comprises **innate immunity** and **acquired immunity** presented in schema 1 and 2 respectively. Innate immunity is non-specific and conservative in evolution. Almost the same mechanisms are noted in primitive and highly developed species like phagocytosis, humoral factors and natural killer cells (NK)(1). Phagocytic cells constitute the first line of defence of the organism against external and internal pathogens, which overcome the so called anatomical barriers.

Phagocytic cell is highly specialised: recognises and reacts on chemotactic stimuli generated in the place of pathogens invasion, leaves the blood vessel, penetrates the infected tissues, adheres, ingests and kills the bacteria. Moreover phagocytic cells i.e. macrophages and granulocytes are necessary in specific immune response because generate regulatory molecules termed interleukin 1 (IL1) and TNF- α . Therefore the special emphasis must be given to the investigation of phagocytosis (1). An inappropriate functioning of these cells could contribute to the decline in activity of lymphocytes and increase of infection incidence presumably upper respiratory tract infection (URTI), which could be easily diagnosed and monitored. The URTI incidence in marathon runners is significantly higher within two weeks after competition versus control runners and amounted 35 to 60% of all participants (2). Our own investigations performed in young football players and competitive cyclists confirms the diminished phagocytosis and other functions of granulocytes that may be responsible for infection incidents (3).

Very important and useful are epidemiological reports performed in different parts of the world after varying levels of exertion. These data have pointed out that heavy efforts increase the susceptibility to bacterial and viral infection. Moderate recreation effort has rather a beneficial effect on immune parameters, but this problem needs more detailed and valid study (4,5).

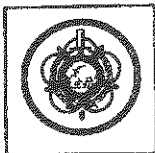
Specific acquired immunity is mostly T lymphocytes dependent and in recent years was intensively studied. T cell sub populations fulfil decisive role in all types of immunity, but precise analyses are very difficult. There are well established and confirmed data that maximal physical effort diminish T helper (CD4) to T suppressor (CD8) cell ratio (6,8). Such general index is very useful in clinical analyses and it can be concluded that effort decreases CD4/CD8 index as well regulatory cytokines production (7,8,9). Such disturbances have resulted in distinct complications observed in peoples submitted to exertion. It was well proved that heavy exercise may cause a bronchospastic response (10). It now widely accepted view that thermodynamic events occurring in the bronchi during exercise may represent the initiating stimulus for bronchospasm. For over 65 years it has been shown that there is an inverse association between exercise and the development of a variety of tumours in former sportsmen Olympic competition winners and world champions (1,4). The transient immunoregulatory dysregulations noted after maximal effort may be responsible for diminished immunological surveillance and tumour development. There are some experimental observations that chronic exercise stress may be responsible for immunological and psychological disturbances. Our own investigations performed before and after intense training and racing season in bicyclist have proved the diminished IL-2 generation and decrease in CD4 cells absolute number. The precise significance of this observation for immunity is hypothetical and controversial (11). It is noteworthy to remark that diminished CD3 cells number, low granulocyte oxidative burst and



considerably reduced IL-2 generation suggest the harmful effect of long-term intensive physical effort on immunity. The other systems of human body may be affected as well. CD4 (helper) cells play an important role in the stimulation's of erythropoiesis (12), their deficiency or diminished activity can disturb this process.

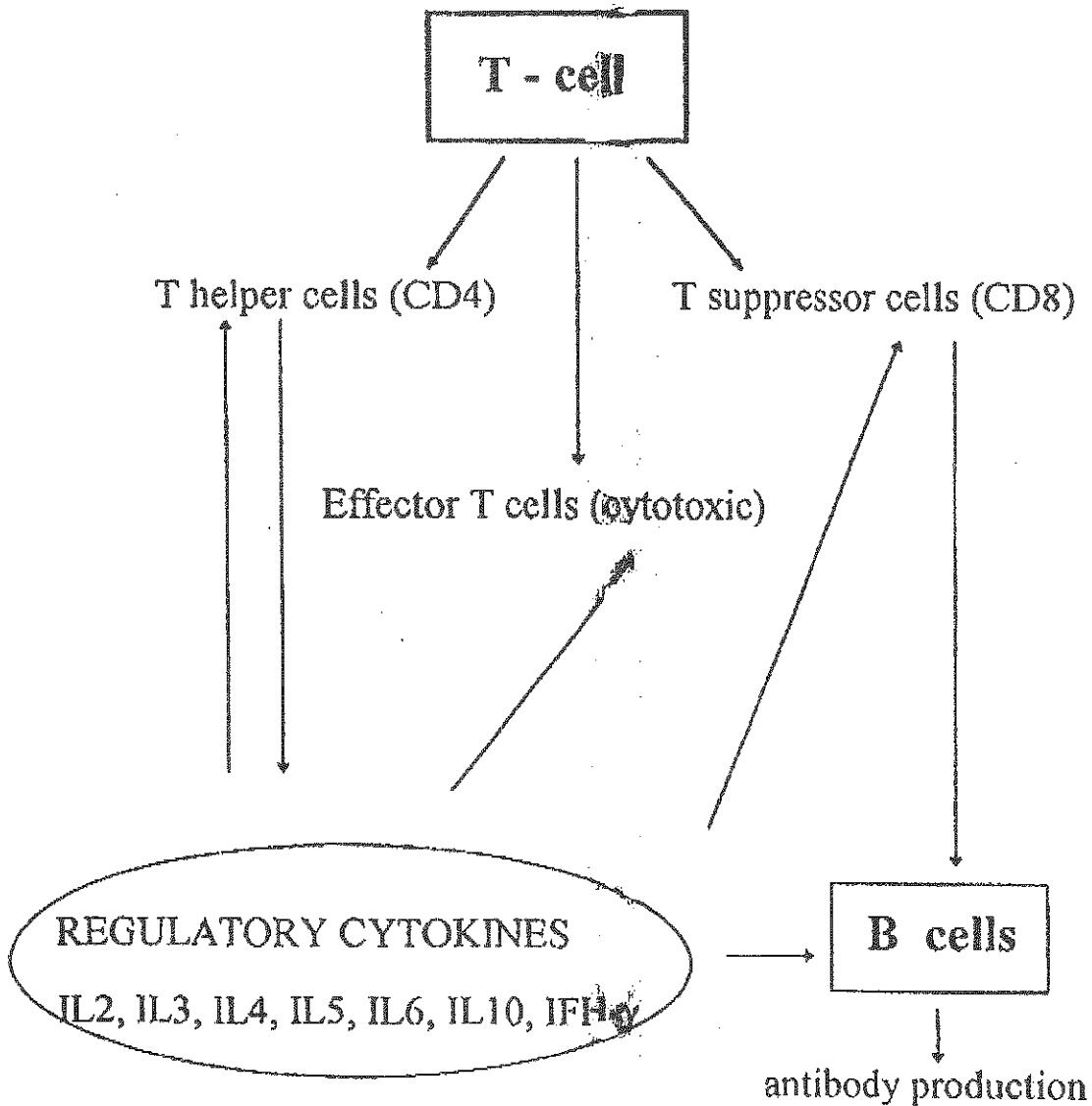
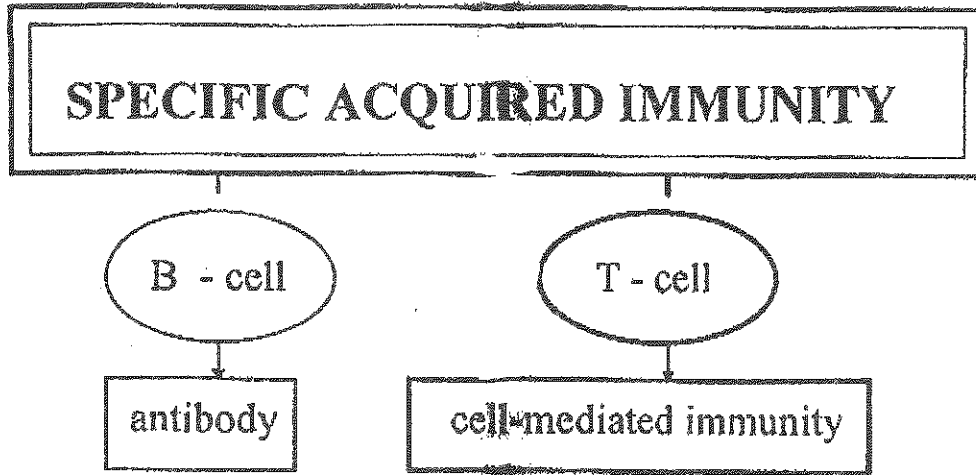
The interesting but not valid observations concern the effects of exercise on autoimmune diseases. Generally it may be assumed that middle effort diminished the disease probability (4).

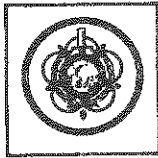
Many areas of effort immunology remain unclear. Some aspects are not well proved such as recreation and regular physical activity, but there are clinical epidemiological observations that regular physical activity is a important component of public health promotion. The careful control of immune parameters in peoples submitted to intense physical effort should become the routine method in every day practice which become very important in the period of maximal physical efficiency and/or effort.



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We live in potentially hostile world filled with infectuous agents. The simplest way to avoid infections is to prevent the bacteria from: gaining access to the body. The major lines of defence are:

INNATE IMMUNITY

ANATOMICAL BARRIERS (skin, mucus)

PHAGOCYtic CELLS

(polymorphonuclear neutrophil, macrophage)

NATURAL KILLER (NK) CELLS

HUMORAL FACTORS (complement system, lysozyme, interferon's)

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PROTECTION

HEALTH

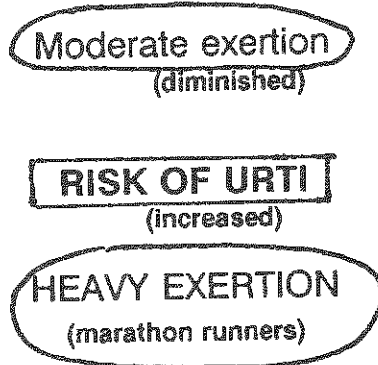


EPIDEMIOLOGICAL REPORTS

Potential relationship between exercise and changes in immune system in humans subjected to varying levels of exertion might explain the altered risk in infection and other disease.



Risk of upper respiratory tract infection (URTI) depends on amount and intensity of exercise.



DIFFERENT CLINICAL AND EXPERIMENTAL OBSERVATIONS PROVE
**INVERSE ASSOCIATION BETWEEN EXERCISE AND
TUMORS**



INCREASED SUSCEPTIBILITY TO INFECTIONS

These effects depend on:



- diminished phagocytosis
- decline lymphocyte function
- decreased immunoglobulin level

