

BIOTECHNOLOGICAL APPROACHES TO ENHANCING THE PHYSICAL AND PSYCHOLOGICAL CAPABILITIES OF MILITARY PERSONNEL

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Abstract:

This article analyzes the role of modern biotechnological approaches in enhancing the physical and psychological capabilities of military personnel. As a result of scientific progress, various technologies have been developed that increase human endurance, resistance to stress, and cognitive performance. In particular, the prospects for enhancing military potential through gene therapy, biochips, neurostimulation methods, rational nutrition, and adaptogenic agents are examined.

Keywords: Biotechnology, military psychology, gene therapy, biochip, neurostimulation, stress resistance.

In modern combat practices, military personnel are required to possess not only high physical readiness but also psychological stability, quick thinking, and the ability to make complex decisions. While traditional training methods remain important, 21st-century technologies enable the artificial expansion of human capabilities. In particular, the introduction of biotechnology into the military sector is radically changing the paradigm in this area.

Gene therapy aimed at enhancing military capabilities can yield positive results in the following directions:

- Increasing muscle strength and endurance by activating genes that boost ATP production;
- Maintaining psychological balance through genes that regulate neurotransmitter balance;
- Modifying gene variants responsible for body temperature regulation and tolerance to hypo- and hypoxia. The U.S. Department of Defense and the People's Republic of China are conducting advanced research in this area. However, due to ethical and legal challenges, the global community approaches this field with caution¹.

Rational nutrition plays a critical role under high physical activity and stress conditions:

- Nanocapsulated vitamins and amino acids ensure fast absorption and prolonged effect;
- Preparations based on adaptogenic substances keep stress hormones under control;
- Probiotics that modulate the microbiome have a direct impact on mental state (via the digestive system).

Using implantable or skin-adhered biochips, the soldier's health condition is monitored in real-time:

¹ DARPA. (2021). *Biotechnologies for military enhancement*. U.S. Department of Defense.

- Heart rate, blood pressure, oxygen levels, and stress indicators are measured;
- Data is transmitted to a secure server and analyzed using AI;
- In case of negative changes, rapid medical response is enabled. This technology is crucial for preventing emergencies during service.

The cognitive potential of soldiers is being enhanced through modern neurotechnologies:

- Transcranial Magnetic Stimulation (TMS): externally stimulates active brain regions;
- Neurofeedback: using brainwave-scanning devices to monitor brain activity, helping the soldier learn conscious control of mental states;
- VR-based stress adaptation simulators – preparing military personnel psychologically for extreme conditions.

The militarization of biotechnologies may lead to a number of challenges:

- Potential negative effects on future generations due to genetic interference;
- Violation of personal privacy through military biochips;
- Unrestricted use of cognitive enhancement tools may infringe on human rights. Therefore, any innovative approach must be implemented based on international standards and subjected to ethical and scientific review².

Conclusion

Biotechnological approaches are among the most promising directions for enhancing military potential. These technologies provide the ability to artificially strengthen natural human capabilities, increase resilience to stress and workload, and monitor health. However, caution, safety, and strict adherence to ethical standards are essential in their implementation.

² World Health Organization. (2020). *Human genome editing: Recommendations and guidelines*. Geneva: WHO.