Effect of alpha-fetoprotein on lifespan of old mice

Alpha-fetoprotein (AFP) is one of the best-known embryo-specific proteins. It is primarily known as an oncomarker for tumors of the liver and gastrointestinal tract, but its antitumor effects have also been shown. AFP is the prevention of mother–fetus autoimmune conflict, probably by suppressing the expression of antigens of the second class of the main histocompatibility complex.

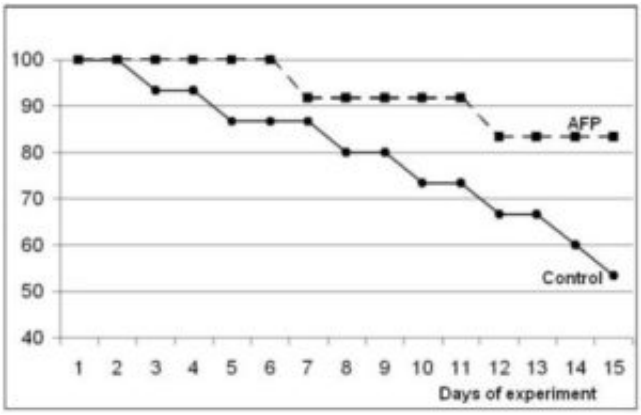

Fig. 1. Effect of alpha-fetoprotein on survival curves of old mice.

Attempts to activate functions of an old organism by introduction of embryonic extracts date back to the beginning of the previous century. They were also used to stimulate various repair processes. Currently, the use of embryonic tissues is a separate rapidly developing scientific and practical area of research. We studied bioactivating effects of embryo-specific protein AFP in old animals, keeping in mind our the immunoregulatory theory of aging and its proven immuno-regulatory activity.

We used 27 mice of the BALB/c line, females aged 18 months old. The drug “Alpha-protein” produced by JSC “Institute of New Medical Technologies” (Russian) was administered to 12 experimental animals for 2 weeks, in the morning, 10 μg per kg of body weight. In 15 control animals, the same saline volume was administered without the drug. In the course of the experiments, we evaluated some parameters of aging as well as survival of animals in the control and experimental groups.

In the experiments, we used a group of mice at late stages of aging, which was reflected in the mortality level in the population: half of the mice in the vivarium had died during the previous 2 months. During the experiment, the natural death of animals in the control group was 47%, while AFP administration reduced mortality to 17% in the experimental group (Fig. 1).

A clear trend towards improvement of the appearance was observed in all the animals treated with

AFP: hair loss and bald areas were reduced, hair glistened, and it lost yellowness and patchiness characteristic of old age. Physical activity of animals was improved: the time of retention on a string changed from 57.3 sek in the control to 77.3 sek in the experiment. Improvement of the physiological state of tissues was also determined based on the increase of intracellular water, which is known to reflect the general condition of cells. Statistically significant increase was observed for the parameters of relative weight of inner organs (heart) and immunity organs (thymus and spleen). Improvement of immune function was registered also based on the reduction of the number of autoantibodies measured by optical density of the solution in the presence of PEG-6000 – this parameter decreased from 0.163 to 0.136 on average. Improvement of the functions of tissues of an aging organism reduces the load of detoxifying animal organs – liver, and kidneys, reducing their weight.

The observed general biological and immunotropic effects of AFP may underlie its general bioactivating action and the increase in survival of mice. Detoxifying, general regulatory, and general trophic properties are especially interesting in this regard since they counteract such well-known aging mechanisms as age-related intoxication, dystrophy, and dysregulation. Immunotropic activity of AFP is an important property AFP can increase immune response and antitumor activity, but counteract age-related increase in immune complexes. Immunotropic activity of AFP may be of particular interest due to its connection to the special function of immunotropic cells – ability to activate directly regeneration of somatic tissues. Based on this effects of immunity, we developed immunoregulatory aging theory: age-related immunodeficiency is directly responsible for the decrease in natural regeneration of renewable somatic tissues and their atrophy with age.

Thus, AFP administration drastically increased the survival of the oldest mice and had a pronounced bioactivating effect in our experiments.

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