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ARCTIC MEDICINE

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MONITORING OF THE SWIMMERS' BODY TEMPERATURE DURING A SWIM ACROSS THE BERING STRAIT

ABSTRACT
The authors reported data on temperature changes in the stomach and on the wrists of the two swimmers during swim across the Bering Strait in conditions of extremely low water temperature (3 ° C to 6 ° C), as well as in the preliminary swim across the river Lena in more favorable conditions. The continuous measurement of the body of the swimmers' temperature was done using a thermologger iBDL DS1922L, which, having a small size and a non-volatile memory can be placed directly inside of the object. The minimum temperature in the stomachs of swimmers during swim across the Bering Strait was fixed at 27 ° C. Measurement of body temperature in extreme environmental conditions can help to study the limit of an organism and to fight with the effects of hypothermia.
Keywords: human body temperature, thermologgers, hypothermia.

The study of a human body reaction, when exposed to low temperatures, is important for the development of medicine in the field of determining the limit abilities of the body. Conduction of such research is accompanied by difficulties of either a purely technical nature or dangers posed by low temperatures to the body of unprepared person. The sensors with sufficient compactness, accuracy and independence are necessary to continuously monitor the temperature of different parts of the body.

The abilities of the trained athletes which are accustomed to extreme cold conditions present particular interest. In nineteen eighty seventh, the American athlete Lynn Cox set a record, swimming for 2 hours and 6 minutes in water of 6 degrees Celsius and covering four thousand one hundred sixty meters of the Bering Strait. Her record was beaten by our fellow countrymen: a unique event was held in August twenty fourteen - swim across the Bering Strait from Little Diomede Island (US) to Ratmanov Island (Russian Federation) (Fig.1). The participants, extreme swimmers Prokopchuk Gregory (from Yakutsk, Russia) and Alexander Brylin (from Blagoveshchensk, Russia) swam almost 5.5 kilometers in water with the temperature of 3 to 6 degrees Celsius for 2 hours.

The route of the swim from the island of Big Diomede to Little Diomede.

The swimmers' body temperature was monitored throughout the swim. The iBDL temperature loggers were chosen as the main tool. iBDL stands for iButton Data Loggers and represents a family of recorders (loggers), commercially produced by the American company Maxim Semiconductors. They are designed to monitor the temperature and humidity. iBDL is a miniature device, which is completely self-contained and secure single-channel electronic recorder. Each device comprises a semiconductor temperature sensor, a real time clock, a non-volatile memory, a microprocessor and a lithium power supply in a MicroCAN sealed steel casing weighing 3.3 g with a diameter of 17 mm (Fig.2). iBDL recorders have an IP56 degree of protection against moisture and dust. This allows the use of these devices in a variety of environments without additional insulation. Due

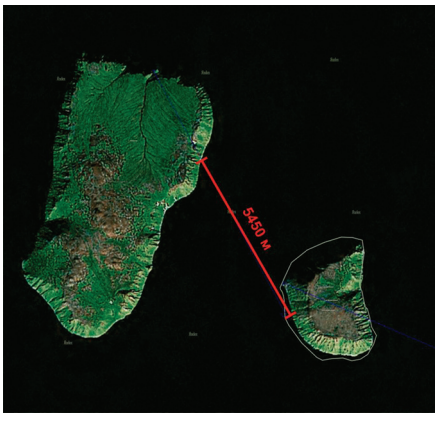

Fig.1. The route of the swim

to the small size one of the sensors can easily be placed in the human stomach by swallowing. The second sensor was attached to the wrist by a conventional medical adhesive. Prior to the start of an experiment the sensors are programmed by the operator. The frequency and the starting time of the registration are set. During our observations sensors were set to register data every 10 minutes. The recorded temperature readings are read from memory with the help of a special device that connects to a computer via USB socket and transmits the data to the computer.

The preliminary testing of the monitoring methodology was held earlier the same year in July during the swim across the Lena River (Fig.3). The water temperature was about 20 degrees Celsius and this swim lasted for about 4 hours. At the start of a swim, the logger, placed in a swimmer's stomach, registered higher than normal temperature (39.23°C). Higher temperature of a trained body just before the swim is a characteristic feature of an extreme swimmer. Consequently, this effect was also observed in the swim across the Bering Strait.

The swim from the Ratmanov Island to Little Diomede Island began on the first of August, 2014 at about 2:20 p.m. and ended at about 4:30 p.m. The water temperature was from 3 to 6 degrees Celsius. Swimmers covered the distance using different strokes, Gregory swam freestyle and was in water for 1 hour and 57 minutes, Alexander swam breaststroke and was in water for 2 hours and 17 minutes. The process of the swim was recorded on video.

At the start of the swim loggers, placed in the swimmers' stomachs, registered the temperature of about 39°C. During the swim temperature in the stomachs gradually dropped to a value of about 27° C. After the finish it took about 8 hours before the normal body temperature was restored. The sensors, which were attached to the wrists of the swimmers, registered the temperature of about 10°C.

Experts say that the overall body chill to such temperatures (20°C - 28°C) is considered as a severe hypothermia and can result with a heart failure. **Thus we have recorded unique abilities of prepared and trained human body.**

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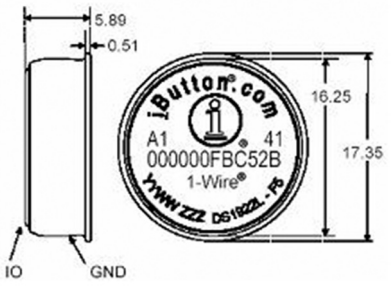

Fig.2. Temperature logger

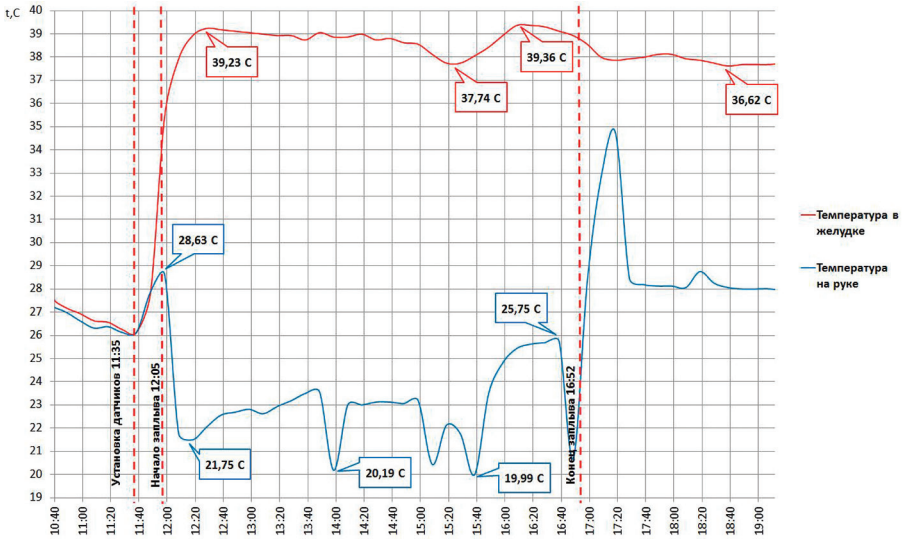

Fig.3. The swimmer's body temperature changes during the swim across the Lena River

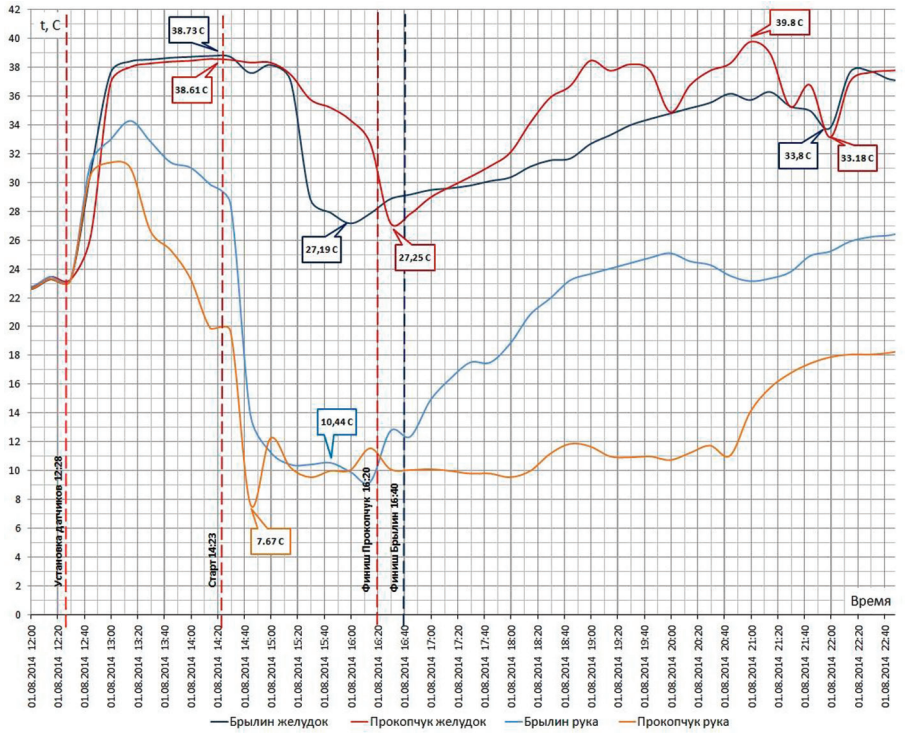

Fig.4. The swimmer's body temperature changes during the swim across the Bering Strait

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CHANGE OF THE GENERAL CLINICAL PARAMETERS AND INDICATORS OF CARDIOVASCULAR SYSTEM AT A HYPOTHERMIA OF DOGS

ABSTRACT

The article describes some clinical data on influence of low temperatures on organism of dogs in an experiment.

Keywords: temperature, dogs, hypothermia.

Relevance. The phenomenon of an anabiosis it is widespread in wildlife. Usually it is taken for such condition of an organism at which vital processes are so slowed down that there are no implications of life as an anabiosis. When favorable conditions occur normal intensity of vital processes is restored. The big contribution to development of ideas of an anabiosis was made by the Russian physicist and the biologist experimenter Porfiry Ivanovich Bakhmetyev. At the beginning of the 20th century, investigating the hibernation phenomenon at animals under natural conditions, he found out that in an organism these animals have a sharp depression of vital activity of all organs. They as if plunge into a condition of the «slowed-down» life - an anabiosis. P. I. Bakhmetyev reduced the body temperature of bats to - 9 degrees, and then resuscitated them.

The foundation for studying of a deep hypothermia at mammals was started by the researches conducted mainly on small animals (groundhogs, gophers, hamsters, rats). The obtained data allowed to be find an opportunity to artificially reduce the body temperature of these animals to 0 — 5 ° and even lower, and then in 1 — 2 hours to try to obtain restoration of all vital signs of an organism by only one heating .

Studying of a deep hypothermia at mammals in the Republic of Sakha (Yakutia) were carried out by Akhremenko A. K., Anufriyev A. I. who carried out mainly on fine animals (groundhogs, gophers) [2, 3].

The hypothermia has strongly entered medicine. For the last 15 — 20 years in many countries researches conduct experiments on a large scale and the works confirming thoughts of a possibility of use of cooling in the medical purposes are published. The prominent surgeons of many countries use this method as an agent, warning operational shock or as strong anesthetic. With use of a hypothermia it has become possible to perform difficult endocardial operations when the condition of the patient doesn't allow to apply a usual narcosis or when operation is so long and difficult that, despite a narcosis, in connection with strong exaltation of a nervous system at the patient shock can occur. In these conditions an important role is played by inherent hypothermia factors, namely: dropping of metabolic processes, retardation of respiration and cordial activity, dropping of sensitivity of an organism [1, 4, 5, 6, 7].

It is known that strong cooling is a trauma for an organism. In the conditions of low temperatures in Yakutia the question of the general hypothermia remains urgent as the lethality remains high.

In medicine the hypothermia and a problem of resuscitation of an organism remains open. For the last 15 — 20 years in many countries researchers conducted on a large scale and the works confirm thoughts of a possibility of resuscitation of an organism [1] were published.

In modern conditions of development of the Arctic the problem of a frigorism and hypothermia of an organism gains applied character.

Purposes and tasks: Studying of the general clinical parameters and indicators of cardiovascular system at a cold trauma of dogs in the conditions of low temperatures of Yakutia.

At the same time the following tasks are set:

1. To tap pattern of fall of temperature of a body, rectal and muscular temperatures.

2. To establish changes of indicators of an ECG at an artificial hypothermia of dogs.

3. To acquire methods of resuscitation of an organism at a hypothermia.

Original materials of a research.

Work was performed from 2015 to 2017 on the basis of faculty of veterinary