



**St. Petersburg Institute of Bioregulation and Gerontology**  
**St. Petersburg, Russia**

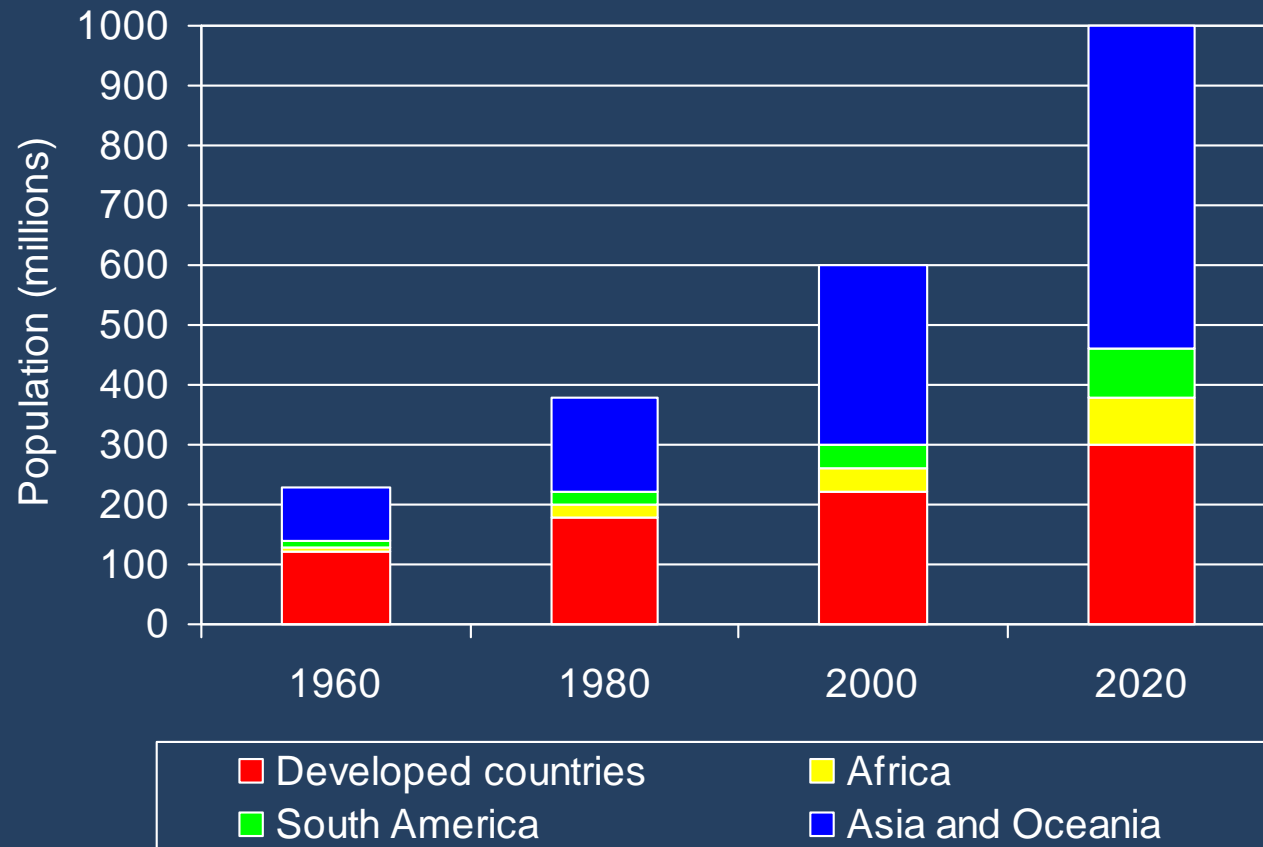
**INCREASE OF ORGANISM VITAL  
RESOURCE:**

**INFLUENCE OF SHORT PEPTIDES  
ON BRAIN FUNCTION**

Prof. Galina Ryzhak

## Population distribution in the age of 60 years old and older in the main regions of the world (1960 - 2020)

*U.N.O. department of population*



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## **INSTITUTE of BIOREGULATION and GERONTOLOGY, ST.PETERSBURG**

Established in 1992, on the basis of the  
Research Laboratory of Bioregulators at the  
Military Medical Academy

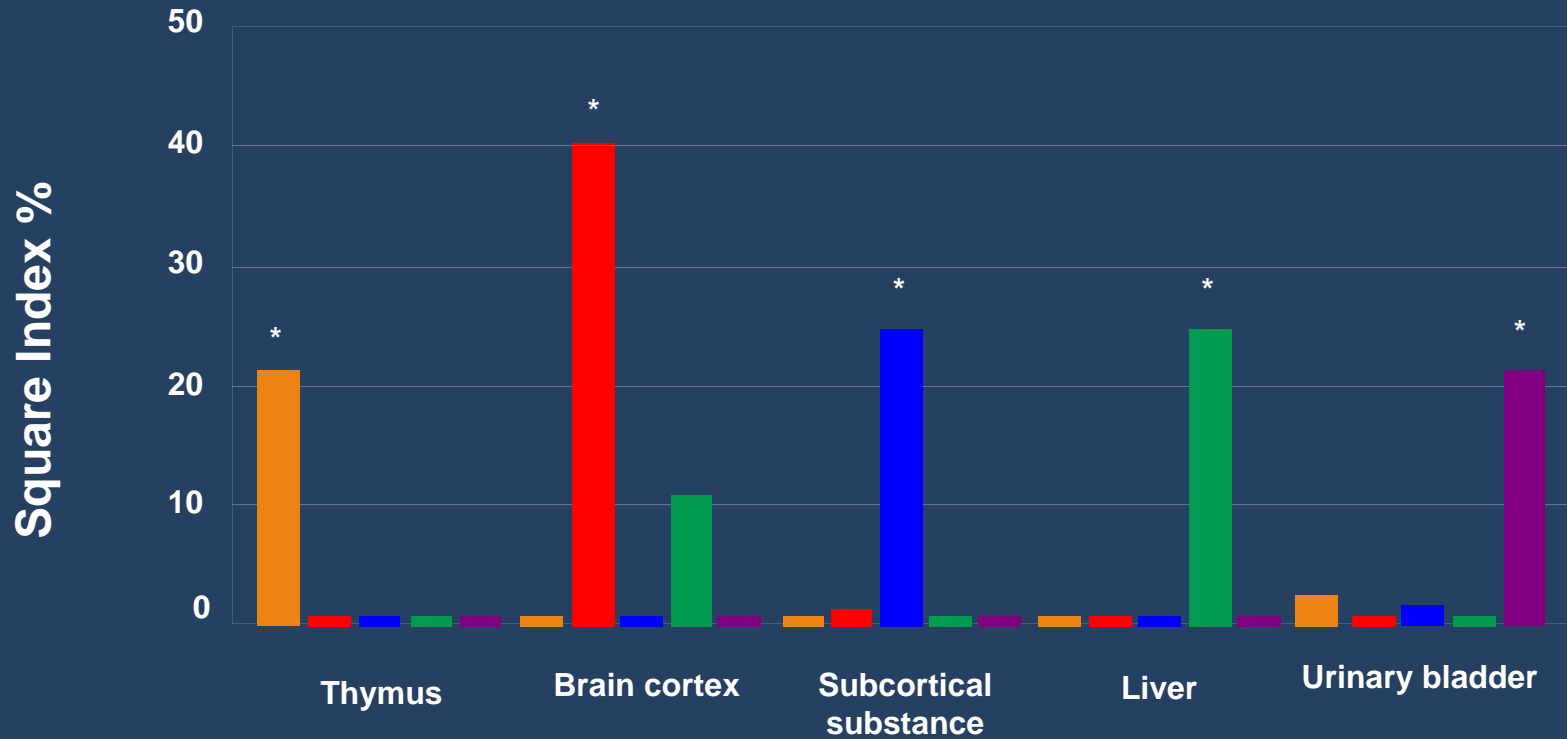


### **The main spheres of the Institute activity are:**

- To study the properties and mechanisms of action of peptide bioregulators
- To study the influence of peptide bioregulators on the mechanisms of aging
- To develop and integrate with medical practice new parapharmaceuticals and drugs based on peptide bioregulators

- **Thymalin** – *treatment of immunity disorder*
- **Epithalamin** – *treatment of neuroendocrine system disorder*
- **Prostatilen** – *treatment of prostate function disorder*
- **Cortexin** – *treatment of neurological diseases*
- **Retinalamin** – *treatment of retina eyes pathology*

## Tissue specific peptide's properties



Thymus peptide	+	-	-	-	-
Epiphysis peptide	-	+	-	-	-
Brain peptide	-	-	+	-	-
Liver peptide	-	-	-	+	-
Urinary bladder peptide	-	-	-	-	+

## Developed products with peptides

Medicines – 6

Food supplements – 38

- on base of short peptides
- on base of the extracts from animal tissues

Cosmetic products - 10

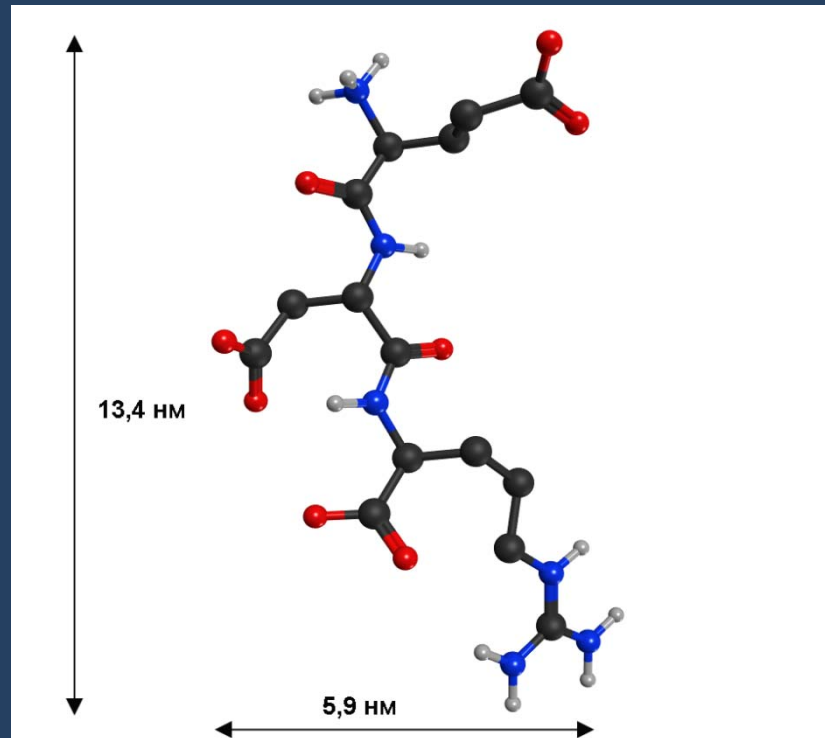
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## Cytogens – short synthesized peptides (food supplements)

<b>PINEALON®</b>	<b>Glu-Asp-Arg</b>	Brain bioregulator
<b>CRYSTAGEN®</b>	<b>Glu-Asp-Pro</b>	Immune system bioregulator
<b>CARTALAX®</b>	<b>Ala-Glu-Asp</b>	Cartilage and bone tissues bioregulator
<b>VESUGEN®</b>	<b>Lys-Glu-Asp</b>	Vessels bioregulator
<b>CHONLUTEN®</b>	<b>Glu-Asp-Gly</b>	Respiratory system bioregulator
<b>OVAGEN®</b>	<b>Glu-Asp-Leu</b>	Liver bioregulator

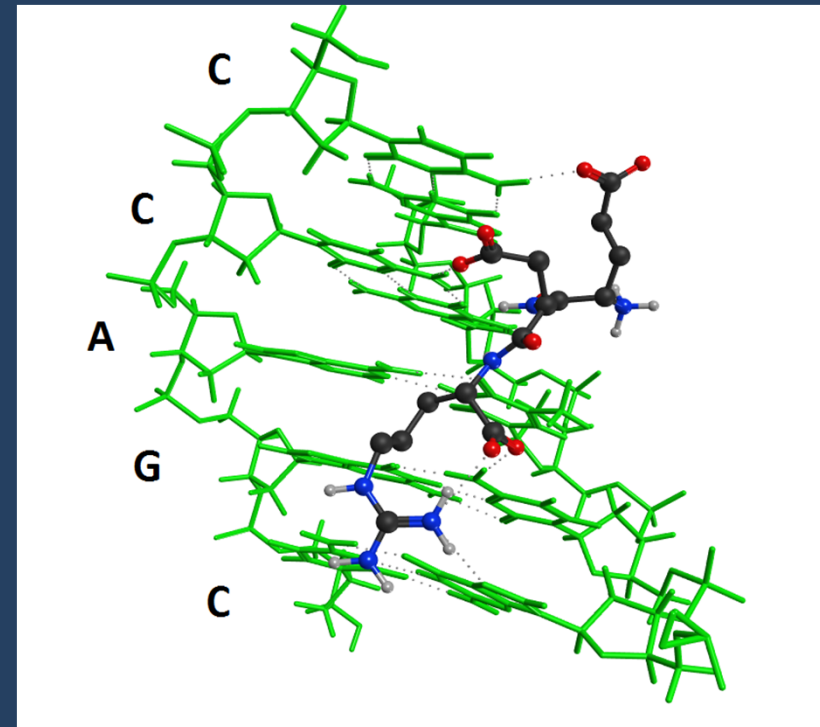
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## Pinealon tripeptide structure (Glu-Asp-Arg) and molecular mechanism of its action



3D structure of Pinealon  
(Glu-Asp-Arg)

 - Nitrogen    - Oxygen    - Carbon



Interaction of Pinealon with specific site **d(CCAGC)**  
in HSPA1A gene promoter region  
(heat-shock protein 70 kD)

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## Materials and Methods of the Experiment

### Objects of the investigation – LIO\* line rats:

1. Young rats (n=50) - 3-4 months
2. Old rats (n=50) – 24 months

Acute hypobaric hypoxia (AHH) was induced by placing the rats into an influx-and-extract pressure chamber (0,029 MP) for 3 hours.



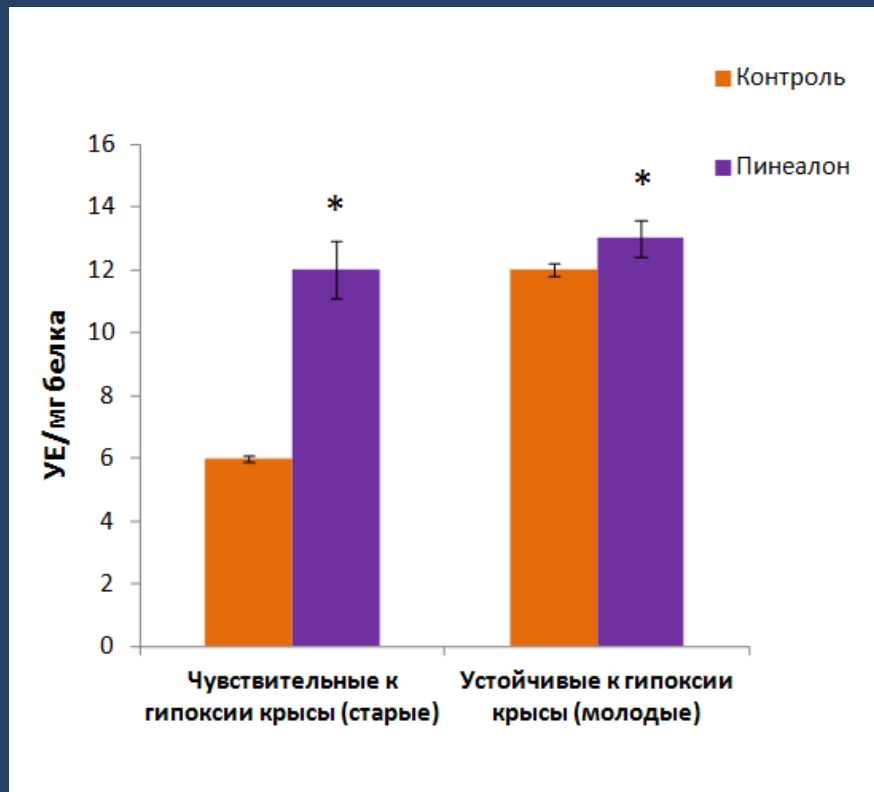
### Experimental groups:

1. Control
2. AHH modeling
3. Pinealon administration (dosage - 10  $\mu\text{g}/\text{kg}$ ) before AHH

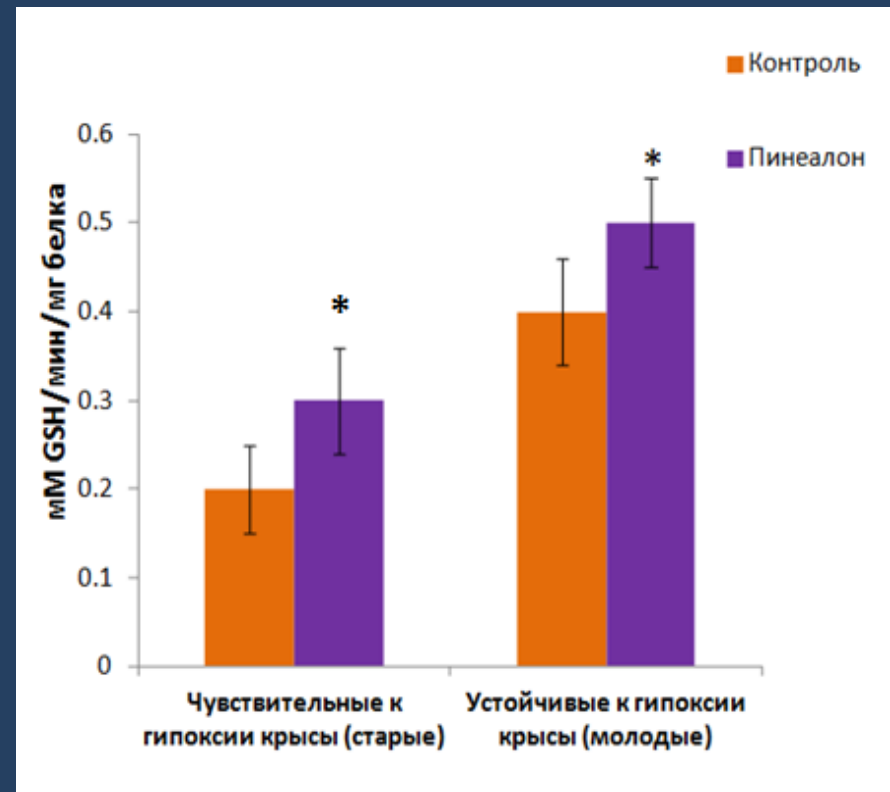
\*LIO – Leningrad Institute of Oncology



## The effect of Pinealon on rats resistance to hypoxia influence



The effect of Pinealon on superoxide dismutase activity in the brain of young and old rats

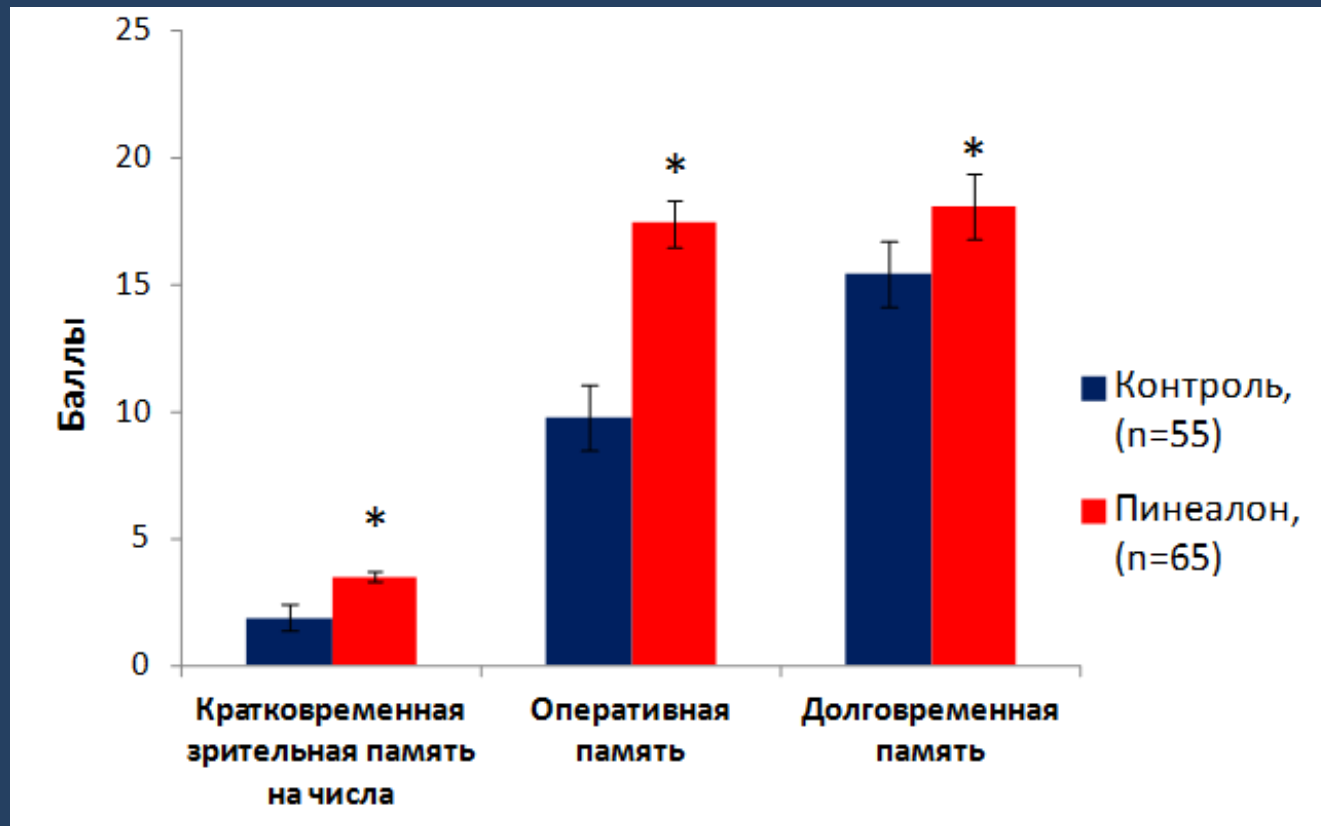


The effect of Pinealon on glutathione peroxidase activity in the brain of young and old rats

\* - p < 0,05 as compared to control

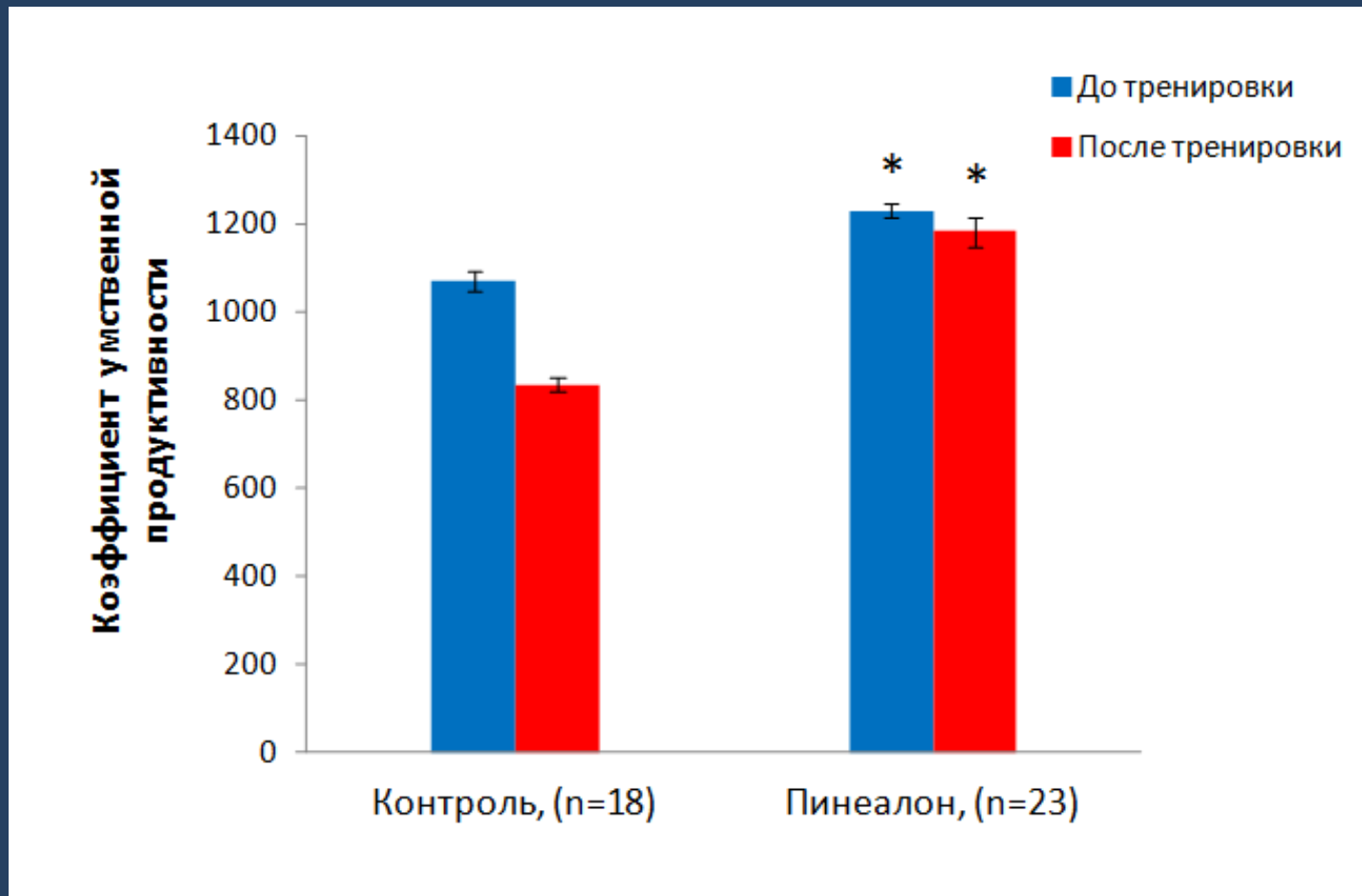
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## The effect of Pinealon on intellectual brain functions in men of old age under the influence of extreme factors



\* -  $p < 0,05$  as compared to corresponding control

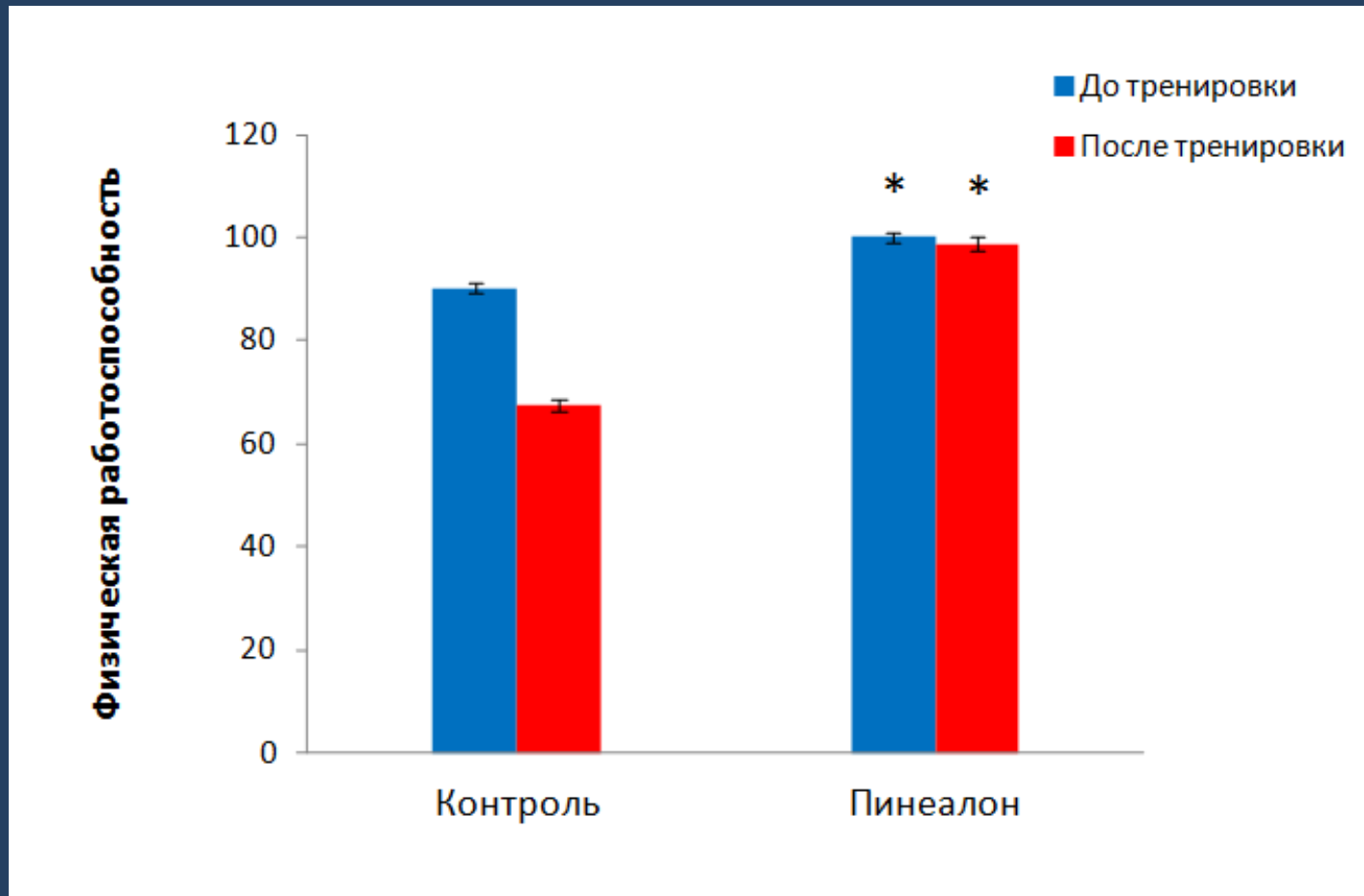
## The effect of Pinealon on intellectual working capacity of sportsmen (wrestlers)



\* -  $p < 0,05$  as compared to corresponding control

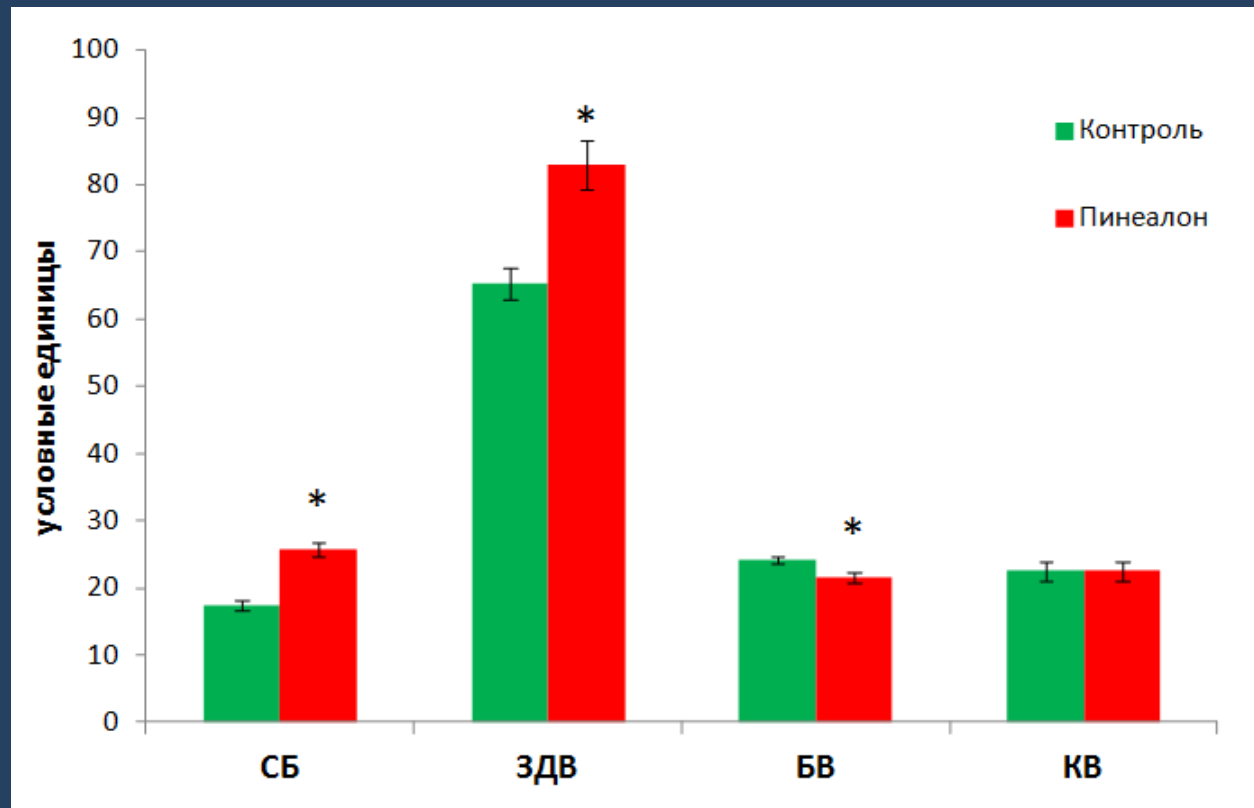
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## The effect of Pinealon on physical working capacity of sportsmen (wrestlers)



\* -  $p < 0,05$  as compared to corresponding control

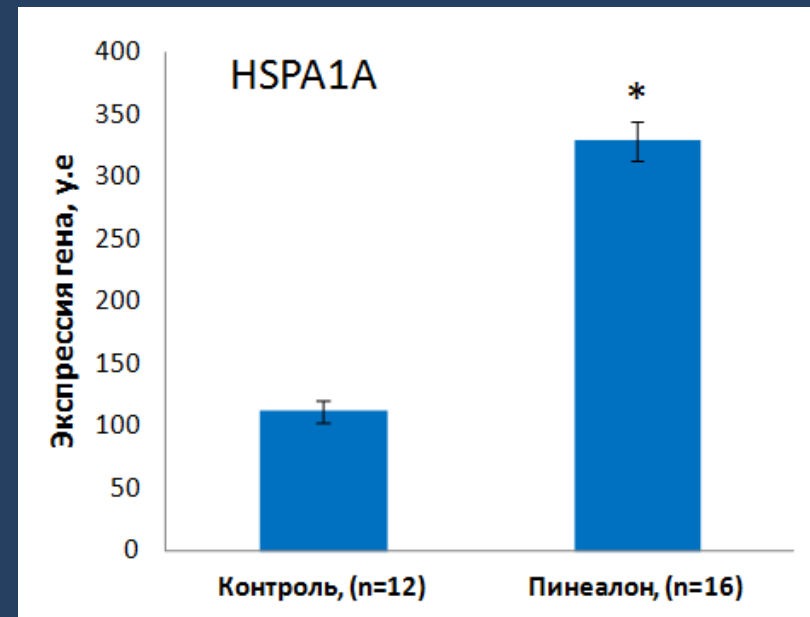
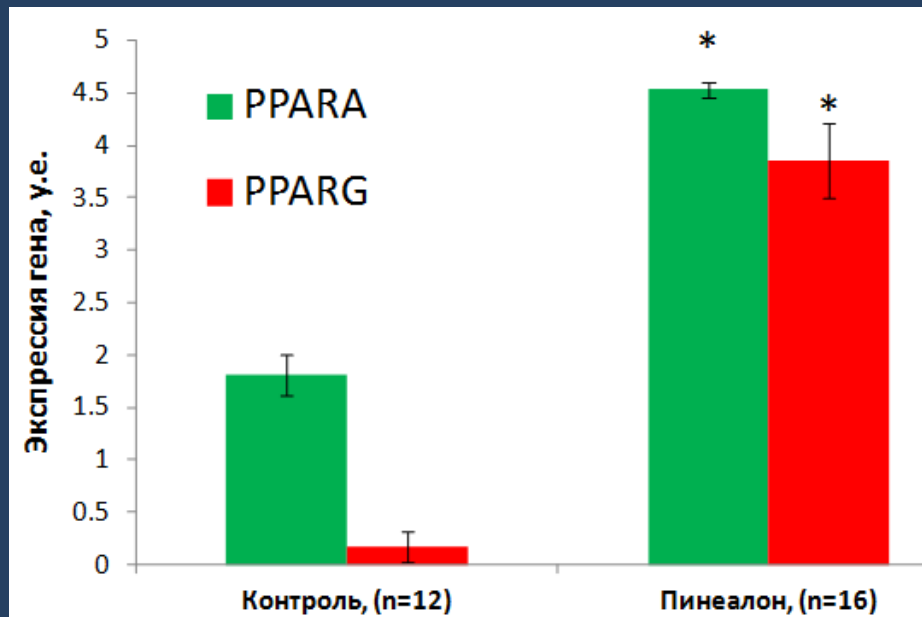
## The effect of Pinealon on biological age indices and ageing rate in sportsmen (wrestlers)



**СБ** - the duration of static balance    **ЗДВ** - the duration of breath-holding after a deep breath  
**БВ**- biological age    **КВ**- calendar age

\* -  $p < 0,05$  as compared to control

## The effect of Pinealon on gene expression in sportswomen (rhythmic gymnastics)



**PPARA & PPARG** – genes increasing the oxidative capacity of skeletal muscles

**HSPA1A** – gene inducing the production of heat-shock protei70 κD (anti-stress activity).

\* -  $p < 0,05$  as compared to corresponding control

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## The Russian Olympic team in rhythmic gymnastics (head coach I.A. Winner-Usmanova)



## CONCLUSION

- 1. Pinealon** increases resistance of animals to hypoxia and provides protection against oxidative stress induced by it. It reveals itself through the increased activity of antioxidative enzymes (superoxide dismutase and glutathione peroxidase) in the brain of old rats subjected to hypoxia
- 2. Pinealon** contributes to the **improvement** of mental and physiological indices characterizing intellectual function in the brain of men of older age under the influence of extreme factors.



## CONCLUSION

- 3. Pinealon** recovers the indices of physical and mental working capacity, reduced by intensive training, in sportsmen.
- 4. Pinealon** regulates the expression of genes responsible for stress-protection of the human organism, which allows increasing significantly the reserve capacities of sportsmen organisms.
- 5. Pinealon** is a perspective preparation to increase the reserve capacities of central neuro system in people suffered the influence of extreme factors.

**Thank You  
for Your Attention!**



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