Basic and Applied Thermophysiology

Edited by
V.N. Gourine

Minsk, 2000

ФУНДАМЕНТАЛЬНЫЕ И ПРИКЛАДНЫЕ АСПЕКТЫ ТЕРМОФИЗИОЛОГИИ

Доклады и сообщения участников международного симпозиума
"Фундаментальные и прикладные аспекты термофизиологии"
(19-21 сентября 2000 г., Минск, Беларусь)

Basic and Applied Thermophysiology

Под редакцией
В.Н. Гурина
Edited by
V.N. Gourine

Минск
Полибиг, 2000

УДК 612.55
ББК 52.5
Б17

Millennium Symposium
Basic and Applied Thermophysiology
Minsk, September 19-21, 2000

Editor:

Prof. Dr. Valery N. Gourine (Minsk, Belarus)

Co-editors:

Prof. Dr. Vladimir A. Kulchitsky (Minsk, Belarus)
Prof. Dr. Barbara Tzschentke (Berlin, Germany)

Language editor:

A.I. Prudnikovich

Книга составлена из докладов и сообщений участников международного симпозиума "Фундаментальные и прикладные вопросы термофизиологии" (19-21 сентября 2000 г., Минск, Беларусь), обсуждавших фундаментальные и прикладные аспекты регуляции температуры тела в норме и при патологии.

The book includes 51 papers of the participants of the International Symposium "Basic & Applied Thermophysiology" (September, 19-21 2000, Minsk, Belarus) from 13 countries, dealing with fundamental and practical aspects of the regulation of body temperature in health and disease.

ISBN 985-6178-77-0

DEVELOPMENT OF THE CENTRAL NO-ERGIC SYSTEMS IN ONTOGENESIS OF MATURENATE MAMMALS

V.I. Dunai

National State University, Minsk, Belarus

It has been demonstrated that nitric oxide (NO) synthesized by nerve cells performs various functions in the central nervous system and is involved in the central mechanisms of thermoregulation, in particular [1, 2, 5]. In different classes of endotherms NO-synthesizing neurons are known to be located in the hypothalamic and medullary nervous centres, which contribute to the regulation of thermoregulatory effector activity. The similarity in the distribution of NO-synthase-containing nerve cells in the hypothalamus and medulla of mammals and birds reflects the significance of NO-dependent systems represented in the higher thermoregulatory centres of two different endothermic classes. In immature-born mammals (rats) in early postnatal ontogenesis the appearance of NO-synthase-containing nerve cells in some structures of the hypothalamic area coincides with the establishment of thermoregulation as a systemic function [3].
The aim of the present work was to study maturation of the NOergic brain systems in early postnatal guinea pigs as representatives of maturate mammals.

MATERIALS AND METHODS

Experiments were performed on 20 guinea pigs. Group I were animals of 1 day of life, group 2–3 days, group 3–10 days, and group 4–20 days of age. The method of Scherer-Singler for identification of NOS/NADPH-diaphorase-containing neurons was used [6]. After craniotomy the brains was wholly removed. The hypothalamus and medulla were separated and fixed according to recommendations of Matsumoto et al. (1993) for 60-90 min in 4% paraformaldehyde on phosphate buffer (0.1 M, pH 7.4) [4]. Microtome sections (25 μm) were incubated in 0.1 M Tris-HCl (pH 8) containing NADPH (1 mM), tetrazolium nitroblue (0.5 mM), and Triton X-100 (0.3%) for 1-2 h at 22°C.

RESULTS AND DISCUSSION

It was found that in guinea pigs in the first days after birth the hypothalamic area underwent considerable changes in the distribution of NADPH-diaphorase / NOS-containing cells. Thus, between 3 and 10 postnatal days the distribution pattern of NO-synthase-containing cells, characteristic of the adult, is mainly formed (Table). Another distinction is the absence of noticeable changes in the distribution of NO-synthesizing nerve cells in the medulla oblongata. These data suggest that in guinea pigs as mature-born mammals the formation of the NOergic

system occurs at earlier stages of postnatal ontogenesis than in immature animals, e.g. rats [2].

Table. Distribution of NADPH-diaphorase / NOS-containing nerve cells in hypothalamic structures of guinea pigs at different postnatal days

№	Structures	Day 1	Day 3	Day 10	Day 20
1.	Medial preoptic area	-	+	+	+
2.	Lateral preoptic area	+	+	+	+
3.	Supraoptic nucleus	-	-	-	+
4.	Paraventricular nucleus	+	+	+	+
5.	Periventricular nucleus	-	-	+	+
6.	Lateral hypothalamic area	+	+	+	+
		-	+	+	+
7.	Medial mammillary nucleus	+	+	+	+
8.	Supramammillary nucleus				

"+" – the structure contains NADPH-diaphorase / NOS-positive nerve cells;
"-" – the structure does not contain NADPH-diaphorase / NOS-positive nerve cells

References

1. Amir, S., De Blasio, E., English, A.M. (1991) NG-Monomethyl-L-arginine co-injection attenuates the thermogenic and hyperthermic effects of E2 prostaglandin microinjection into the anterior hypothalamic preoptic area in rats. *Brain Res.*, 556: 157-160.
2. Gourine, A.V. (1994) Role of nitric oxide in lipopolysaccharide-induced fever in conscious rabbits. *J. Physiol.*, 475: 28P.
3. Gourine, A.V. (1995) Pharmacological evidence that nitric oxide can act as an endogenous antipyretic factor in endotoxin-induced fever in rabbits. *Gen. Pharmac.*, 26: 835-841.
4. Matsumoto, T, Nakane, M, Pollock, J.S., Kuk, J.E., Forstermann, U. (1993) A correlation between soluble brain nitric oxide synthase and NADPH-diaphorase activity is only seen after exposure of the tissue to fixative. *Neurosci Lett.*, 155: 61-64
5. Taylor, W.F. & Bishop, V.S. (1993) A role for nitric oxide in active thermoregulatory vasodilatation. *Am.J.Physiol.*, 264: H1355-H1359.
6. Scherer-Singler, U., Vincent, S.R., Kimura, H. &, McGeer, E.G. (1983) Demonstration of a unique population of neurons with NADPH-diaphorase histochemistry. *J. Neurosci. Methods.*, 9: 229-234.

CONTENTS

A GREETINGS AND A PREFACE (**John Bligh**, The Babraham Institute, Cambridge, U.K.) 9

Short Reviews and Theoretico-experimental Articles

HYPERTHERMIA-INDUCED CONVULSIONS IN EARLY POSTNATAL ONTOGENESIS IN WAG/RIJ RAT: PRO-CONVULSIVE ROLE OF PITUITARY ADENYLATE CYCLASE-ACTIVATING PEPTIDE (PACAP) AND ARGININE-VASOPRESSIN
S.A. Chepurnov, N. E. Chepurnova, A. A. Ponomarenko & E.L.J.M. van Luijtelaar 14

POLYSACCHARIDE COMPONENTS OF EXOGENOUS PYROGENS PRODUCE FEVER IN RATS
M.D. Doğan, H. Ataoğlu & E.S. Akarsu 26

THERMOREGULATORY ALTERATIONS DURING FASTING AND RE-FEEDING: A ROLE FOR ABDOMINAL SIGNALS
Á. Ember, G.Y. Gőbel, E. Pétervári & M. Székely 31

ABSENCE OF INDIVIDUAL DIFFERENCES IN THE MANIFESTATION OF HYPERTHERMIA DURING EMOTIONAL ORIENTATIVE STRESS REACTION IN RATS IN THE "OPEN FIELD" TEST
A.V. Gourine & K.V. Sudakov 37

PHARMACOLOGICAL ANALYSIS OF INHIBITORY INFLUENCES, INCLUDING THOSE OF GABA, ON THE BRAINSTEM CENTRES CONTROLLING HEAT EXCHANGE PROCESSES
V.N. Gourine 39

UNEXPECTED APPEARANCE OF BROWN PREADIPOCYTES INDUCED BY DEXAMETHASONE
A. Korać, Je. Radovanović & V. Davidović 45

INTERSCAPULAR BROWN ADIPOSE TISSUE MASS REGRESSION DURING RE-ADAPTATION AFTER COLD-INDUCED HYPERPLASIA: CONTRIBUTION OF APOPTOSIS
B. Korać, A. Korać & B. Buzadžić 51

PLASTICITY OF THE BRAINSTEM NEURONAL NETWORKS DURING ENDOTOXEMIA AND AFTER INJECTION OF CAPSAICIN TO THE CAUDAL VENTROLATERAL MEDULLA
S.V. Koulchitsky 57

Basic and Applied Thermophysiology

OSMOTICALLY-INDUCED PHASIC FIRING IN THERMOSENSITIVE NEURONS OF THE PREOPTIC/ANTERIOR HYPOTHALAMUS
I.E. Kuznetsov & V.N. Kazakov **62**

PHOTOPERIODICITY, THERMOREGULATION, AND BIORHYTHMS
V.A. Matukhin & A.N. Razumov **69**

ONTOGENY OF THERMOREGULATION IN PRECOCIAL BIRDS
M. Nichelmann & B. Tzschentke **73**

THERMOREGULATORY MECHANISMS OF BRAIN TEMPERATURE DECREASE AND INCREASE DURING NOCTURNAL SLEEP IN PIGEONS
Yu.F. Pastukhov, I.V. Yekimova, M.E. Rashotte, E.V. Sedunova, E.A. Guselnikova, R.P. Henderson, A.L. Zimin & O.A. Sapach **96**

CHANGES IN THE AFFERENT ACTIVITY OF SUPERIOR MESENTERIC NERVES, INDUCED BY APPLICATION OF LIPOPOLYSACCHARIDE *E. COLI* INTO THE SMALL INTESTINAL LUMEN
V.V. Soltanov, A.G. Chumak & A.Yu. Rudaya **103**

APPLIED ASPECTS OF THERMOREGULATION AND HEAT EXCHANGE IN HEAT STRESS
F.F. Sultanov & G.F. Sultanov **110**

PROBLEMS OF EPIGENETIC TEMPERATURE ADAPTATION IN BIRDS
B. Tzschentke & M. Nichelmann **115**

BRAIN TEMPERATURE REGULATES ACTIVITY OF THALAMOCORTICAL CIRCUIT
R. Veskov, V. Vasilev, N. Joksić & Lj. Rakić **129**

ADAPTIVE CHANGES OF TITIN ISOFORM COMPOSITION IN SKELETAL AND CARDIAC MUSCLES OF HIBERNATING GROUND SQUIRRELS
I.M. Vikhlyantsev, I.V. Makarenko, Ya.N. Khalina, M.D. Shpagina, S.N. Udaltsov, S.L. Malyshev & Z.A. Podlubnaya **133**

OPIOID RECEPTOR AGONISTS INDUCED CHANGES IN TEMPERATURE SENSITIVITY OF PO/AH NEURONS - A BASE OF THE CHANGES IN BODY TEMPERATURE
K.S. Yakimova & Fr.-K. Pierau **139**

Research Papers and Short Reports

BLOOD LEUKOCYTE HEAT SHOCK PROTEIN 72 kDa, INTERLEUKIN-1 AND NITRIC OXIDE GENERATION UNDER HEATING OF HEALTHY MEN
L.I. Andreeva, A.A. Boykova, V.S. Petrova & P.D. Shabanov **148**

MORPHOFUNCTIONAL CHANGES IN SOME AUTONOMIC GANGLIA AND INTERNAL ORGANS, SUPPLIED BY THEM, IN PYROGEN-EXPOSED ANIMALS
L.I. Archakova, N.P. Denisenko & S.A. Novakovskaya **152**

BRAINSTEM NEURONAL ACTIVITY DURING HYPERTHERMIA IN ANESTHETIZED RATS
O.A. Azev, D.M. Poputnikov, V.V. Gorbachev & V.N. Gourine **156**

ANTIOXIDANT DEFENSE IN THE LIVER OF COLD ADAPTED RATS AND DURING RE-ADAPTATION TO ROOM TEMPERATURE
B. Buzadžić & B. Korać **159**

EFFECT OF HEAT EXPOSURE ON THE RAT BRAIN ANTIOXIDATIVE ENZYME ACTIVITIES
G. Cvijić, J. Djordjević & V. Davidović **166**

THE ACTIVITY OF ANTIOXIDANT ENZYMES AND MONOAMINE OXIDASE IN THE BROWN ADIPOSE TISSUE OF HYPOTHYROID RATS EXPOSED TO COLD STRESS
V. Davidović, N. Petrović, R. Radojičić & G. Cvijić **172**

EFFECT OF HIGH AMBIENT TEMPERATURE ON THE ACTIVITIES OF ANTIOXIDATIVE ENZYMES IN THE RAT BROWN ADIPOSE TISSUE AND SERUM CORTICOSTERONE LEVEL
J. Djordjević, G. Cvijić & V. Davidović **178**

DEVELOPMENT OF THE CENTRAL NO-ERGIC SYSTEMS IN ONTOGENESIS OF MATURENATE MAMMALS
V.I. Dunai **183**

THERMOACCLIMATORY MODIFICATION OF RED CELL HEAT RESISTANCE IN RAINBOW TROUT
A.S. Goryunov, A.G. Borisova & G.A. Sukhanova **185**

FEBRILE RESPONSE IN MICE LACKING α2-MACROGLOBULIN GENE
A.V. Gourine, K. Rudolph, L. Umans, F. van Leuven, V.N. Gourine & M.J. Kluger **189**

Basic and Applied Thermophysiology

EFFECTS OF TEMPERATURE, pH, AND NITRIC OXIDE ON THE NEURONAL ACTIVITY OF THE CENTRAL RESPIRATORY GENERATOR IN *LYMNAEA STAGNALIS*
V.B. Kazakevich, A.V. Sidorov, L.L. Moroz & V.N. Gourine **192**

A HYPOTHERMIC EFFECT OF EXCITATION OF THE CENTRAL α-ADRENOREACTIVE SYSTEMS IN CONDITIONS OF ANGIOTENSIN-II RECEPTOR BLOCKADE
E.A. Kondratenkova **195**

DECREASING SURFACE ACTIVE PROPERTIES OF PULMONARY SURFACTANT: A COINCIDENCE OR A REGULARITY THAT MAKES HYPERALGESIA DISAPPEAR IN CONDITIONS OF ENDOTOXEMIA IN SUBDIAPHRAGMATICALLY VAGOTOMIZED RATS?
S.V. Koulchitsky, S.M. Funtova, S.V. Tkachev, A.A. Ushkov, S.G. Pashkevich, O.V. Bomberova & V.A. Kulchitsky **198**

CONVERGENCE OF CORTICAL IMPULSES TO HYPOTHALAMIC NEURONS DEALING WITH THE TEMPERATURE HOMEOSTASIS CONTROL
P.Ya. Kravtsov, L.V. Natrus, A.V. Tereshenko, N.V. Prokofieva & B.G. Popov **203**

THE PATTERN OF THERMOREGULATORY RESPONSES TO HIGH AMBIENT TEMPERATURE AND ENDOTOXIN IN CONDITIONS OF TOXIC LESION OF THE LIVER
E.N. Kuchuk & F.I. Vismont **209**

STRUCTURAL CHANGES IN THE PREOPTIC AREA OF THE ANTERIOR HYPOTHALAMUS OF RATS AT DIFFERENT AGES IN EARLY POSTNATAL ONTOGENESIS IN CONDITIONS OF ENDOTOXIN OR PROTEOLYSIS INHIBITOR ACTION
I.V. Laman, L.I. Archakova, I.A. Melnikov & V.A. Matukhin **212**

CHANGES IN THE AFFERENT ACTIVITY OF THE VAGUS NERVE AND IN NO-SYNTHASE ACTIVITY IN NEURONS OF THE INTERMUSCULAR PLEXUS OF THE STOMACH AND INTESTINE AFTER INJECTION OF LIPOPOLYSACCHARIDE IN CONDITIONS OF NITRIC OXIDE SYNTHESIS BLOCKADE
V.I. Lapsha, V.N. Bocharova, L.N. Utkina, N.A. Stepanova, F.I. Vismont & V.N. Gourine **215**

RECEPTOR BINDING OF GROWTH FACTORS AS A MOLECULAR MECHANISM MEDIATING THE EFFECT OF HYPERTHERMIA ON PHEOCHROMOCYTOMA PC12 CELLS
V.S. Lukashevich & V.N. Nikandrov **220**

Basic and Applied Thermophysiology

INFLUENCE OF COLD ENVIRONMENT ON EMG-PARAMETERS OF MUSCLE FATIGUE AND RECOVERY
A. Meigal, L. Gerasimova & Yu. Lupandin **225**

INTRACEREBROVENTRICULAR αβ-METHYLENE ATP INFLUENCES BODY TEMPERATURE IN CONSCIOUS RATS
E.V. Melenchuk, D.M. Poputnikov & A.V. Gourine **229**

ROLE OF BIOGENIC AMINES IN ACTIONS OF ADAPTOGENS ON BODY TEMPERATURE AND BEHAVIORAL ACTIVITY OF ANIMALS IN THERMONEUTRAL CONDITIONS
E.V. Pereverzeva & V.A. Pereverzev **232**

THE INFLUENCE OF ACUTE COLD EXPOSURE ON THE ANTIOXIDANT ENZYME ACTIVITIES AND UNCOUPLING PROTEIN-1 CONTENT IN THE RAT BROWN ADIPOSE TISSUE
N. Petrović, G. Cvijić & V. Davidović **236**

EFFECT OF I.C.V. GABA-ERGIC AGONISTS ON THE HEART RATE DURING NORMO-, HYPER-, AND HYPOTHERMIA IN ANAESTHETIZED RATS
D.M. Poputnikov & E.V. Melenchuk **243**

EFFECTS OF INDOMETHACIN ON BODY TEMPERATURE, INTERLEUKIN-6 ACTIVITY, AND THE CONTENT OF THYROID AND STEROID HORMONES IN BLOOD OF RATS DURING ADJUVANT-INDUCED HYPERTHERMIA
I.N. Semenenya **246**

INFLUENCE OF HYPERTHERMIA ON THE MORPHOFUNCTIONAL STATE OF THE THYROID GLAND
S.N. Sherbakov, N.I. Tarapata, E.V. Gaydarova, V.F. Andreeva, N.V. Prokofieva & T.A. Shevchenko **252**

EFFECT OF TEMPERATURE ON SIGNAL CONDUCTANCE BY SYNAPSES FORMED BY PEPTIDERGIC NEURON VD4, IN THE NERVOUS SYSTEM OF *LYMNAEA STAGNALIS* (L)
A.V. Sidorov **259**

THE REGULATORY EFFECTS OF THYROLIBERIN IN MONKEYS AT LOW TEMPERATURE CONDITIONS
T.N. Sollertinskaja **262**

Basic and Applied Thermophysiology

ROLE OF THE NERVOUS SYSTEM IN THE REALISATION OF EFFECTS OF MAGNETIC FIELDS ON THE NOCICEPTIVE REFLEXES DURING ENDOTOXEMIA
D.N. Tchitchkan, V.S. Ulashchik & V.A. Kulchitsky **266**

MILD HYPOTHERMIA ATTENUATES POSTTRAUMATIC EPILEPTOGENESIS
R. Veskov, V. Vasilev, N. Joksić & Lj. Rakić **271**

INVOLVEMENT OF KUPFFER CELLS IN THE GENERATION OF THERMOREGULATORY RESPONSES TO ENDOTOXIN
F.I. Vismont & K.N. Hryshchanka **274**

A COMPARATIVE ANALYSIS OF THE RESPONSE OF ENDOCRINE ORGANS OF MATURE- AND IMMATURE-BORN ANIMALS IN ADAPTATION TO COLD IN THE EARLY POSTNATAL PERIOD
T.A. Vylegzhanina, T.E. Kuznetsova, O.A. Maneyeva & E.L. Ryzhkovskaya **277**

CHANGES IN SOME NEUROPEPTIDES AND HORMONES IN PERIPHERAL BLOOD DURING FEVER
Y.B. Yolkin & S.B. Kondrashova **282**