Physiologist 22(4):56;1979

EFFECT OF CALCIUM ANTAGONISTS ON A MUSCLE WHICH HAS LITTLE OR NO SARCOPLASMIC RETICULUM. Robert B. Hill. Bermuda Biological Station, St. George's West, Bermuda.

The longitudinal retractors of the body wall of Isostichopus badionotus have little or no sarcoplasmic reticulum and yet they have cellular stores of calcium which suffice for EC coupling for up to ten hours of incubation in calcium-free solutions of chelating agents. It has been hypothesized that the major calcium stores are in the sarcoplasmic reticulum and its extraordinary extensions. In this study calcium antagonists have been used in order to identify the site of calcium stores for EC coupling in ACh contracture, in caffeine contracture, and in tetanus. Closely reproducible contractions can be elicited over a very long period of time by 10^{-8}M ACh in eserinized muscle, by 10 mM caffeine in muscle pretreated with ionophore, and by subfusion tetanus. All are reversibly blocked by Mn, nearly irreversibly blocked by La, and not blocked at all by Danotrolene. This supports the hypothesis that calcium stores for EC coupling are located in the membrane and not in intracellular sites.

CARDIOVASCULAR RESPONSE OF RATS EXPOSED TO 60-HZ ELECTRIC FIELDS. David I. Hilton* and Richard D. Phillips. Battelle Pacific Northwest Laboratory, Richland, WA 99352.

Recent studies have shown that exposure to high-strength electric fields can influence electrocardiogram (ECG) patterns, heart rates and blood pressures in various species of animals. Our studies were designed to evaluate these reported effects and to help clarify some of the conflicting reports in the literature. Various cardiovascular parameters were measured in Sprague Dawley rats exposed (or sham exposed) to 60-Hz, 80- or 100-kV/m fields for periods through 4 mo. No significant differences in heart rates, ECG patterns, blood pressures or vascular reactivity measurements were found between exposed and sham-exposed rats after 8 h, 40 h, 1 mo or 4 mo of exposure. Blood pressure and heart rate measurements, also taken during exposure to a 100 kV/m field for 1 h, revealed no significant differences between exposed and sham-exposed groups. In addition, physiological reserve capabilities, measured in rats exposed to 100 kV/m for 1 mo and then subjected to cold stress, showed that electric field exposure had no significant effect on the animals' physiological response to the cold stress. Our studies cannot be directly compared to the work of other investigators because of differences in animal species and electric field characteristics. Our failure to detect any cardiovascular changes may have been the result of eliminating secondary field effects such as microcurrent shocks, corona and ozone.

AUTOANTICOAGULATION DURING ARTERIOVENOUS PERFUSION IN DOGS: INTRA- AND EXTRACORPOREAL REQUIREMENTS. L. B. Hinshaw, B. Beller-Todd*, L. Archer*, B. Benjamin*, T. Murphy*, S. Sofer*, and F. B. Taylor, Jr.*. VA Medical Center and Univ. Oklahoma Health Sci. Ctr., Oklahoma City, OK 73104.

Our laboratory has developed an arteriovenous extracorporeal perfusion system in dogs which results in autoanticoagulation and "infinite" Lee-White whole blood clotting time (>24 hr)(Circ. Shock, in press). To extend and refine this system, we studied intra- and extracorporeal requirements for the "autoanticoagulation" phenomenon. The intracorporeal system was tested using intact and eviscerated dog preparations. The extracorporeal system was studied by varying the individual components, including tubing, pump, reservoir, and the introduction of exogenous heparinization. We found that the liver must be present in the intracorporeal system to achieve infinite clotting time. The non-occlusive roller-type pump was required in the extracorporeal system to attain infinite clotting time, while the reservoir was optional and either plastic or rubber tubing was equally effective. Furthermore, early minimal exogenous heparinization (1.0 mg/kg) did not interfere with, nor accelerate, "infinite clotting time". Termination of perfusion resulted in restoration of normal clotting time within 3 hr, and infusion of 1 mg/kg of protamine rapidly restored normal clotting time during perfusion. (Supported by VA Med. Ctr., US Navy Project N00014-76-C-0229, and NIH Program-Project HL17812.)

VAGAL REFLEX ACTIONS OF PROSTAGLANDINS IN THE CAT. T.H. Hintze*, M.J. Panzenbeck* and Gabor Kaley. Dept. of Physiology, New York Medical College, Valhalla, N.Y. 10595.

The purpose of this study was to examine the role of the vagus nerve in the heart rate and blood pressure responses to injections of arachidonic acid (AA), prostaglandins (PG) and nitroprusside (NP). Anesthetized male cats with carotid arteries tied (in order to blunt baroreflex function) received intravenous AA (1,2,3 mgs), PGI_2 (5,20,40 µg), PGE_1 (5,10 µg), PGE_2 (5,10 µg), $PGF_{2\alpha}$ (10,20,30 µg) or NP (25,50, 100 µg) before and after bilateral vagal section (N=6), atropine (N=6) and indomethacin (N=15). The increase in heart rate and the decrease in blood pressure to PGE_2, PGE_1 and NP were unchanged by vagotomy, atropine, or indomethacin. In contrast $PGF_{2\alpha}$, PGI_2 and AA caused bradycardia and a decrease in pressure. The fall in heart rate was significantly attenuated or reversed by atropine or vagotomy indicating vagal participation in the response. In addition, tying the carotid arteries potentiated the bradycardia to AA and PGI_2. Indomethacin inhibited the reduction in heart rate and blood pressure to AA and $PGF_{2\alpha}$ but had no effect on the PGI_2 induced changes. These results suggest that release of PGI_2 is responsible for the heart rate and blood pressure lowering effects of both AA and $PGF_{2\alpha}$. In summary, the injection into the cat of $PGF_{2\alpha}$ or PGI_2 as well as the in vivo synthesis of PGs cause the activation of a vagal reflex, most probably within the heart, resulting in cardiac slowing and hypotension (Supported by the Whitehall Foundation).

EVOLUTION OF SENESCENCE: INFLUENCE OF SURVIVORSHIP PATTERNS ON THE RATE OF INCREASE OF POPULATION. Henry R. Hirsch. Dept. of Physiology and Biophysics, U. of Kentucky, Lexington, Ky. 40536

A model population is proposed in which senescence is identified with an increase in death rate with age and in which selective advantage is measured by the Malthusian parameter, i. e. by the rate of population growth when the age distribution is stable. It is assumed that the birth rate is constant or changes exponentially with age and that the time derivatives of the survivorship curves are gamma density functions of integral order n. The survivorship curves are normalized such that the mean longevity is independent of n, but, with increasing n, the death rate is reduced at early ages and is augmented in old age.

The Volterra equation is derived from a general renewal equation, applied to the model population, and solved for the Malthusian parameter. An example is given in which the Volterra equation has more than one real root. In general, higher values of n, which favor greater survival in youth at the expense of lesser survival in old age, lead to increases in the Malthusian parameter that reflect greater selective advantage. The results illustrate and support Medawar's conclusion (1) that senescence would evolve even in the absence of need for a post-reproductive period of parental care.

(1) Medawar, P. B. An Unsolved Problem of Biology. London: H. K. Lewis, 1952.

CEREBROSPINAL FLUID ACID-BASE HOMEOSTASIS DURING ASPHYXIC DIVING, HYPERCAPNIA, AND ANOXIA IN TURTLES. B.M. Hitzig* and E.E. Nattie, Dartmouth Med. Sch., Hanover, NH 03755.

Turtles can maintain prolonged apneic dives and emerge in good condition. To study the CSF changes associated with diving and assess the contribution of the components of asphyxia (hypercapnia and anoxia), unanesthetized turtles (Pseudemys scripta elegans, 1-2 Kg) were subjected to 2h simulated anoxic dives (n=6), 2h of hypercapnia (8% CO_2 in air) (n=5), or 2h of N_2 breathing with normocapnia (n=4). Measurements were made of arterial pH, and arterial and CSF TCO_2, $[Na^+]$, $[K^+]$, and $[Cl^-]$. Comparisons with suitable controls revealed a significant ionic change in the CSF following each stress. Hypercapnia resulted in a marked increase in both CSF $[Na^+]$ and TCO_2, whereas anoxia resulted in a large decrease in TCO_2. The decrease in CSF TCO_2 during diving was much less than in the anoxic state, indicating that hypercapnia acted in a manner which helped stabilize CSF acid-base status. The CSF $[Cl^-]$ was lower than control during diving, but was slightly higher than control in anoxia. Changes in $[Na^+]$ increased the CSF strong ion difference resulting in maintenance of acid-base balance by effecting suitable changes in the $[HCO_3]$.

CSF	Control	Dive	Hypercap	Anoxia
$[Na^+]$	130 mEq/L	146	144	148
$[K^+]$	2.7	3.5	3.6	3.5
$[Cl^-]$	100	93	99	104
TCO_2	32.5	30.5	44.6	21.1

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APS FALL SCIENTIFIC MEETING

Guest Organizations: Commission on Gravitational Physiology - IUPS
Biosciences Section of the Gerontological Society

October 15-19, 1979
New Orleans Hilton Hotel
New Orleans, Louisiana

CALENDER OF EVENTS

Monday A.M. October 15

Refresher Course - Grand Ballroom C

MONDAY P.M. OCTOBER 15

Refresher Course - Grand Ballroom C
Seminar - The Congressional Process - Grand Ballroom C—4:30
Reception for new members - Grand Ballroom C—6:30
General Mixer - Grand Ballroom D—8:00

TUESDAY A.M. OCTOBER 16

Symposium - Grand Ballroom D
Capillary Permeability and Mechanisms of Transport, Session I: A Salute to Professor H.S. Mayerson

Turtorial Lectures - Grand Ballroom C
Metabolic and Endocrine Alterations in Shock
Endogenous Pyrogen Control
Substance P

Symposium - Grand Ballroom B
Aging

Miniseminar - Exhibit Area - Grand Salon B
Space Environment Workshop

Slide Sessions:
Neonatal Circulation - Grand Ballroom A
Airway Epithelial Function - Salon 5/8
Regulation of Breathing: Reflex - Salon 11/14
Cardiac Dynamics - Salon 3/6
Gravitational Physiology I - Salon 9/12
Renal Ion Transport and Metabolism I - Marlborough Suite B
Epithelial Transport I - Prince of Wales
Environmental Physiology (Altitude, Chronobiology) - Cambridge

Poster Sessions - Grand Salon A
Hypertension I
Immunophysiology

Teaching of Physiology - Learning Resource Center

TUESDAY P.M. October 16

Symposium - Grand Ballroom D
Capillary Permeability and Mechanisms of Transport, Session II

Symposium - Grand Ballroom B
Procedural approaches to Gravitational Physiology

Miniseminar - Exhibit Area - Salon B
Space Environment Workshop

Tutorial Lectures - Grand Ballroom C
Hormones and Hypertension
Advances in Hypertension
Introduction of Physiology as a Professional Discipline into American Medical Schools

Bowditch Lecture - Grand Ballroom C - 4:30

Slide Sessions:
Shock I - Grand Ballroom A
Pulmonary Mechanics: Airways - Salon 5/8
Lung: General and Diffusion - Salon 11/14
Myocardial Metabolism - Salon 3/6
Temperature Regulation, Hypothermia and Hibernation Salon 9/12
Aging: Physiological Considerations - Marlborough Suite A
Regulation of Extracellular Volume and Osmolality - Marlborough Suite B
Epithelial Transport II - Prince of Wales

Teaching of Physiology - Learning Resource Center

WEDNESDAY A.M. OCTOBER 17

Symposium - Grand Ballroom D
Respiratory Cardiovascular Interaction

Symposium - Grand Ballroom B
Use of Ionophores and Antibiotics in Studies of Epithelia

Tutorial Lectures - Grand Ballroom C
Neural Control of Cerebral Blood Flow
Local Control of Cerebral Blood Flow
Biotelemetry and Animal Models in the Study of Regulation of Ventilation

Miniseminar - Exhibit Area - Grand Salon B
Space Environment Workshop

Slide Sessions:
Microcirculation - Grand Ballroom A
Gestation, Sex Hormones and Reproduction - Salon 3/6
Gravitational Physiology II - Salon 9/12
Cardiac and Smooth Muscle Chemistry - Marlborough Suite A
GI Motility - Prince of Wales

Poster Sessions - Grand Salon A
Coronary Physiology
Arrhythmias
Aging: Biological Considerations
Renal Transport and Metabolism

Teaching of Physiology - Learning Resource Center

WEDNESDAY P.M. OCTOBER 17

Symposium - Grand Ballroom D
Tissue Oxygen Consumption and Vascular Resistance

Tutorial Lectures - Grand Ballroom C
Current Concepts on the Regulation of Renal Ammonia Production and excretion
Avian Renal Function
Hyperbaric Physiology