

ACTIVATION OF UPPER AIRWAY MUSCLES BEFORE THE ONSET OF INSPIRATION IN NORMAL MAN. K.P. Strohl*, M.J. Hensley*, M. Hallett*, N.A. Saunders* and R.H. Ingram, Jr. Peter Bent Brigham Hospital and Harvard Medical School, Boston, MA 02115

Animal studies have demonstrated that activation of upper airway muscles precedes the onset of inspiration. To investigate whether this sequence occurs in man, we studied three healthy males in the supine position during quiet wakefulness and non-REM sleep. We measured electromyographic (EMG) activity of the alae nasi (AN), genioglossus (GG), and diaphragm (DI) by surface, fine wire and intraesophageal electrodes, respectively. Onset of inspiration was determined by EMG-DI, airflow by facemask and pneumotachograph, or transdiaphragmatic pressure. Sleep state was determined by electroencephalography. During sleep, phasic activity in AN (3 subjects) and GG (2 subjects) consistently preceded the onset of respiration by up to 600 msec. (mean 200 to 300 msec.). During wakefulness, phasic activity in AN and GG could not be detected in many breaths due to the presence of tonic activity: when present during quiet breathing, phasic activity in GG and AN preceded inspiration by a shorter and more variable period when compared to sequences observed during sleep; voluntary breaths produced simultaneous onset of AN/GG and inspiration. These findings suggest that in man a sequence of respiratory muscle activation occurs which is more apparent and less variable during sleep. (Supported by grants from NIH (HL 16463, HL 20968, GM 07560-02), PGMF Syd. Uni. and RACP)

MECHANICS OF BREATHING DURING EXERCISE IN AIRFLOW OBSTRUCTION. D. G. Stubbings*, J.L.C. Morse*, L.D. Penzelly, N.L. Jones, St. Joseph's Hospital/McMaster University, Hamilton, Ontario, Canada.

We used an exercise body plethysmograph to study pulmonary mechanics in 6 subjects with chronic obstructive lung disease at rest and in steady state exercise at 200 and 400 kpm/min. The mean age was 51 years and mean FEV₁ 63% of predicted. The flow rates during tidal breathing at rest reached the maximum expiratory flow volume (MEFV) curve in most subjects; on exercise they all reached the MEFV curve during tidal breathing. During exercise functional residual capacity and total lung capacity did not change, but residual volume (RV) increased to 113.3% of the value at rest. Dynamic compliance (C_{dyn}) fell to 52.8% of the control value but static compliance was relatively unchanged at 90.2% of control. Expiratory resistance (R_{lex}) increased to 118% of control value. The MEFV curves did not change. The fall in C_{dyn} may be due to increases in tidal volume and/or respiratory frequency. The increase in R_{lex} is probably due to increased expiratory pressure generated when breathing on the MEFV curve during exercise. Despite these marked dynamic changes there was no change in static pulmonary mechanics (Supported by the Canadian Lung Association).

PRODUCTION OF MONOCLONAL ANTIBODIES TO HUMAN GASTRIN.

R.L. Suddith*, C.M. Townsend*, P.L. Rayford and J.C. Thompson. Department of Surgery, The University of Texas Medical Branch, Galveston, Texas 77550.

Hybrid cells which secrete gastrin-specific antibody have been derived from fusions between mouse myeloma cells and spleen cells from mice immunized with synthetic human gastrin I (SHG I). Gastrin antibodies produced by hybridomas were detected in the culture supernates by solid phase radioimmunoassay. Spleen cells (10⁸) from Balb/c mice immunized with SHG I were fused to myeloma cells (10⁷) of either the P3x63Ag8 or the nonsecretory P3-NS-1 cell line using polyethylene glycol. The initial fusion progeny were plated into 96-well microtiter plates. Hybrids were selected by their ability to grow in hypoxanthine aminopterin thymidine medium. Conditioned media from hybridomas were transferred to polystyrene tubes. Protein from these media is passively bound to the wall of the tubes. The presence of gastrin-specific antibodies was measured by the amount of ¹²⁵I gastrin bound in each tube. Background binding was 2% of input counts (12,000/tube). Hybrids producing antibodies which bound at least 4 times background were selected. 41 of 1080 (4%) of P3x63Ag8 cell hybrids secrete gastrin-specific antibody, whereas 11 of 540 (2%) of the hybrids with P3-NS-1 did so. These studies show that it may be possible to develop monoclonal antibodies to peptide hormones; this development will facilitate studies on molecular heterogeneity.

ANALYSIS OF GI MOTOR ACTIVITY USING A GRAPHIC-TO-DIGITAL CONVERTER. Charles M. Suter*, Herbert S. Ormsbee, Gordon L. Telford*, and G. Robert Mason. U. of Md. Hosp. Baltimore, Maryland 21201

Recently, several low cost graphic-to-digital converters have become available which translate strip chart records into computer readable format. The practicality of using such a device for analysis of GI motility data is reported here. Precalibrated extra-luminal strain gage force transducers were sewn to the GI tract of 6 anesthetized dogs. Contractile activity was recorded on an 8-channel strip recorder for a variety of experimental conditions. The strip chart was placed on a graphic-to-digital converter and selected points were converted to sets of computer readable coordinates by positioning a manual cursor over the points. The coordinates of the base and peak of each contraction were used to calculate motility indices, areas under the contraction curves, and tonic shifts. These were printed in tabular form or graphed on the computer plotter or graphic display. Comparison with manual analysis of the same data revealed excellent agreement (r=0.871). The use of a computer oriented graphic-to-digital analysis of GI motility data has increased the speed, accuracy, and amount of information obtained. (Supported in part by the Frank C. Bressler Research Fund)

EFFECTS OF MICROWAVE-INDUCED HYPERTHERMIA ON THE RAT BLOOD-BRAIN BARRIER. Carl H. Sutton* and Frederick B. Carroll* (SPON: V. Popovic) Dept. of Neurological Surgery, Univ. of Miami, Miami, Fla. 33152

Sprague-Dawley male rats were used to study the tolerance of the blood-brain barrier (BBB) to microwave irradiation. The rat brains were locally heated with microwaves (2450 MHz) under chloral hydrate anesthesia, while the body of the animals was shielded with Eccosorb. The brain and body temperatures were monitored with thermocouples. Horseradish peroxidase was administered (i.v.) 30 min prior to the animal sacrifice in order to determine possible BBB disruption by microwave heating. After perfusion with 5% PVP in saline at 4°C, the excized brains were homogenized for biochemical and histochemical studies. In normothermic (37°C) rats BBB was disrupted after brain heating for 10 min at 45°C, after 15 min at 42°C and after 60 min at 40°C. In hypothermic (30°C) rats the BBB integrity was lost after heating brains for 15 min at 45°C, after 30 min at 42°C, and after 180 min at 40°C. It is concluded that microwave hyperthermia disrupts the integrity of the BBB to protein (horseradish peroxidase) in the selectively heated rat brain. The tolerance of the BBB to microwave energy is dose-related, depending upon the temperature of brain and the length of the heating. The BBB received significant protection from body core hypothermia, probably through the contact of endothelial cells with cooled blood.

VENTILATORY AND METABOLIC RESPONSES TO STEADY STATE AND PROGRESSIVE SUPINE EXERCISE.

O. Szekely, R. Foster, J.M. Kinney, J. Askanazi, S. Rosenbaum and P. Silverberg (Sponsored by H.H. Bendixen) Dept. of Surgery and Anesthesiology, College of Physicians & Surgeons of Columbia University, New York, NY 10032

This study was conducted to differentiate the ventilatory and metabolic behavior with supine exercise at low levels (V_O2 < 1000 ml/min) from the well documented response to high level upright exercise. Using a canopy system (J. Appl. Physiol 33:523, 1972) for non-invasive measurement of breathing patterns and gas exchange, 9 male subjects were studied while performing steady state (SSE) and progressive exercise (PRE). Work loads were: SSE 1.5 Kgm/sec for 17 min; PRE 1.5, 2.5, 3.75 and 5.0 Kgm/sec with 2 min. increments. Total work was the same (1548 Kgm) in both types of exercise. With steady state exercise tidal volume (V_T) and respiratory rate (f) rose 26% and 60% resp. Minute ventilation (VE) increased 115%. With progressive exercise f rose during the 1st and 2nd work level (36%), then remained constant while V_T and VE increased during all 4 levels (to 146% and 256%). In both cases inspiratory time (T_I) remained fairly constant, but expiratory time (T_E) decreased (SSE: -27%. PRE: -37%). At the same time inspiratory flow increased 73% and 186% in SSE and PRE. The O₂ consumption reached a stable level in 4 minutes in SSE but rose continuously in PRE. This finding shows that in SSE both the V_T and f accounted for the increases in V_E while in PRE the V_T is the dominant factor.

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

Tutorial 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

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 Pro-
duction and excretion

Avian Renal Function

Hyperbaric Physiology

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