

CONTENTS

	Page
Letters to the Editor	325
APS Membership Status	328
Abstracts of Refresher Course - Use of Avian and Large Domestic Animals in Physiological Research	332
Experimental Anesthesia - Electrical Anesthesia in Cattle and Sheep	
Thermoregulation in the Goat	
Behavioral Experiments with Pigeons and Goats	
Adrenal-Pituitary Axis and Aging in Cattle	
High Altitude Studies in Cattle and Sheep	
Arterial Receptors of Aves	
Vascular Changes in Experimental Hypertension in Swine	
Dynamics of the Fetal Lamb Circulation Before and After Birth	
Animal Behavior Society	340
Past-President's Address.....J. R. Pappenheimer	341
Inexpensive Isotonic Muscle Lever for Electronic Recording R. E. Henshaw, G. R. Walters, and John Fisher.....	348
Congress of Radiation Research	352
Gerontology Congress	352
News Items from Senior Physiologists	353
Naples Zoological Station	364
On the Cranial NervesJames R. King	365
Translation of Experiments in Binaural Hearing in Noise	365
Second International Biophysics Congress	366
Index	367

LETTERS TO THE EDITOR

From: Dr. J. Joaquin Izquierdo, Prof. of Physiology, National Univ. of Mexico Faculty of Medicine, Mexico City, D. F., Mexico.

Dear Dr. Daggs:

Last January 22, I wrote to Dr. Hermann Rahn, that the presidential address he read while children were entertained elsewhere (1) offered such a clarifying discussion on the communication crisis we are going through, that at once I drew it to the attention of members of my department. That his version of conditions, great changes and problems affecting universities in our days, was impressive: serenity of the old days gone; our personalities changed, with consequent changes in our academic life; professors only a shade better than the departmental chairmen and these only slightly better than deans. In sum, a lot of facts which apparently are now recognized to fit to all members of a medical school, even in the wildest places of New Guinea.

His experiences in the Coral Sea were so greatly coincident with mine in the past, that I had them briefly summarized for him.

Since we were in the camp at Santo Domingo, * early plans were prepared (2) to make the students learn physiology by the road of experiment, thus getting them exercised in the use of scientific methods and criteria for planning and solving their problems in future practice. To begin with, it was only feasible to lead them through narrow, shallow channels, but for 1944 (3), their courses covered in successive steps, physics and chemistry, general physiology and human physiology. In 1950, when our camp was soon to move to a new spot in the Lava Sea, ** plans for more thorough farther reaching expeditions were prepared (4), but once settled there (1956) the dean declared to have plans of his own, and ordered to have them tried out. Former plans (5) (6) were blamed for being too long for preparing young men for the medical practice, as well as for reflecting stale views on physiology, assumedly superseded by those of biochemistry and pharmacology. Due emphasis was made on the local evolutionary development of programs, systematically directed since 1934, towards the invariable goal of setting physiology as the real, firm foundation for scientific medicine. As to biochemistry and pharmacology, it was made clear that both were outgrowths of a common field which recurred to the same methods for the solution of problems by the way of experiment (7) (8) (9).

But this had no consequence, and the courses after mutilation, were grossly packed down. At last, urgent demands were made, both to have the ill-advised experiment put to an end, and to have reconstructed the necessary steps to have the medical curriculum firmly set upon a sci-

*The old Medical School, down town.

**The New Medical School, at Ciudad Universitaria.

tific basis (10) (11).

As in Dr. Rahn's case, far from being permitted to pull my big turtle on board, I was left hanging over the bow with it in my arms, while the dean manipulated the motor at the stern, tried to run the surf, and lost our way.

This explains why my colleagues and I so greatly enjoyed reading at the very beginning of his address: "Since its beginnings physiology has been in the center of biological foment. It spawned biochemistry, pharmacology, and more recently biophysics and biomathematics. Physiology and its sister sciences have now passed the long lag of the incubation period and are firmly entrenched in the exponential growth phase. Physiology is no longer merely acknowledged, but actively courted by the public, the federal agencies, and the medical profession."

Such a fine declaration, no doubt, will assist us greatly in bringing forth the cause of physiology.

With best cordial wishes and regards,

Yours sincerely,

J. J. Izquierdo

REFERENCES

1. Rahn, Hermann. Past-President's Address. The Physiologist. 7: 334, 1964.
2. Izquierdo, J. J. Balance Cuatricentenario de la Fisiologia en Mexico. Ediciones Ciencia. 358 + vi pages, Mexico 1934.
3. Izquierdo, J. J. Analisis Experimental de los Fenomenos Fisiologicos Fundamentales. Guia para un Curso de Fisiologia General de Laboratorio. Mexico, 1939. xxii + 336 pages, with 73 figures and 2 color plates.
4. Izquierdo, J. J. Ideas Fundamentales para la Estructuracion Material y Funcional del Nuevo Departamento de Fisiologia - de la Facultad de Medicina, basadas en los antecedentes del actual Departamento. Dept. Physiol. Mexico. 1950.
5. Programa para el Curso de Fisiologia. Dept. Physiol. 16 - pages. Mexico. 1956.
6. Programa para el Curso de Fisiologia. Dept. Physiol. 16 - pages. Mexico. 1957.
7. Izquierdo, J. J. La Demostracion y el Experimento en la Nueva Escuela de Medicina (1833-1958). Gaceta Medica de Mexico . 89: 123-140, 1959.
8. Izquierdo, J. J. Las Reformas Fundamentales pendientes de - realizar en la enseñanza de la Fisiologia. Gaceta Medica de Mexico. 89: 205-220, 1959.
9. Bases Fisicoquimicas para que la Fisiologia sea base efectiva en la formacion del medico. Gaceta Medica de Mexico. 91: 499-508, 1961.
10. M. D. A. Editorial. Review of Medical Science, June 1960. Translated in Gaceta Medica de Mexico. 90: 955, 1960.

11. Izquierdo, J.J. Ensayo que urge dar por terminado. Gaceta Medica de Mexico. 92: 627-630, 1962.

From: M. Naqi Shamai, General Secretary of the International Club, Shahid-E-Millat Road, Karachi, Pakistan.

Dear Sir:

We take this opportunity of introducing ourselves as an association of like minded people, dedicated to international understanding and friendship. We have initiated an international gifts exchange scheme and it has been suggested by one of our esteemed American members that the members of your learned society might be interested in it.

It is proposed to start the gifts exchange scheme with Pakistan and the U.S.A. The gifts selected are copies of the archeological findings and handicrafts showing the cultural heritage of Pakistan. These may prove helpful in promoting mutual understanding and friendship. Some of our Pakistani members are bearing complete financial responsibility. It is hoped that your esteemed members shall make the scheme a success by showing their interest and sending us their addresses.

We shall welcome suggestions from your esteemed members to further our cause.

Yours faithfully,
For International Club,

(M. Naqi Shamai)
General Secretary

APS MEMBERSHIP STATUS

SEPTEMBER 1965

Regular members	2487
Associate members	183
Retired members	132
Honorary members	17
	<hr/>
	2819

SUSTAINING ASSOCIATES

Abbott Laboratories
Ayerst Laboratories
Beckman Instruments, Inc.
Burroughs Wellcome and Co.
CIBA Pharmaceutical Products, Inc.
Gilford Instrument Laboratories, Inc.
Gilson Medical Electronics
Grass Instrument Co.
Harvard Apparatus Co.
Hoffman-LaRoche Laboratories, Inc.
Lakeside Laboratories
Eli Lilly and Co.
Merck Sharp and Dohme Research Laboratories
The Norwich Pharmacal Co.
Chas. Pfizer and Co., Inc.
Riker Laboratories, Inc.
A. H. Robins Co., Inc.
Smith Kline and French Laboratories
E. R. Squibb and Sons
The Upjohn Co.
Warner-Lambert Research Institute
Wyeth Laboratories

DECEASED MEMBERS

The following deaths were reported since the 1965 Spring meeting.

J. B. Collip (R) - June 19, 1965
A. C. Corcoran - July 4, 1965
R. C. De Bodo - May 12, 1965
D. R. Drury - May 17, 1965
A. J. Dziemian - May 9, 1965
Davenport Hooker (R) - June 27, 1965
W. H. Lewis (R) - July 1964
H. A. McGuigan (R) - March 1, 1964
F. T. Rogers (R) - December 19, 1964
Charles Sheard (R) - November 1963
D. W. Wilson (R) - July 13, 1965

NEWLY ELECTED MEMBERS

The following, nominated by the Council, were elected to membership in the American Physiological Society at the Fall meeting, 1965.

FULL MEMBERS

ABRAMS, Robert M.: Asst. Fellow, J. B. Pierce Fndn., Yale Univ.
ALEXANDER, Carl S.: Chief, CV Section, VA Hosp., Minneapolis
ANDERSON, Lloyd L.: Asst. Prof. Animal Sci., Iowa State Univ.
BACH-Y-RITA, Paul: Sr. Res. Assoc., Inst. Med. Sci., San Francisco
BLAIR, A. James, Jr.: Asst. Prof. Med., Univ. Hosps., Madison, Wis.
BLISS, Harry A.: Assoc. Prof. Med., Univ. of Illinois
BODIAN, David: Prof., Dept. Anat., Johns Hopkins Univ.
BORG, Donald C.: Scientist, Brookhaven National Lab.
BROOKS, Dana C.: Asst. Prof. Anat., Cornell Univ. Med. Coll.
BROWN, Arthur C.: Asst. Prof. Physiol. & Biophys., Univ. Washington
BUSTAD, Leo K.: Radiobiol. Lab., Univ. of California, Davis
CALDINI, Paolo: Asst. Prof. Environ. Med., Johns Hopkins Univ.
CALDWELL, Frederick T.: Assoc. Prof. Surg., State Univ. New York
CASE, Robert B.: Chief, Lab. Exptl. Cardiol., St. Luke's Hosp., N. Y.
CONRAD, Margaret C.: Instr. Physiol., Bowman Gray Sch. Med.
COSTELLO, Leslie C.: Assoc. Prof. Anat. & Physiol., Univ. Maryland
COTTLE, Walter H.: Assoc. Prof. Physiol., Univ. of Alberta
CRAIN, Stanley M.: Dept. Physiol., Albert Einstein Coll. Med.
CUSHMAN, Paul Jr.: Res. Fellow, St. Luke's Hosp., New York
DABNEY, Joe M.: Asst. Prof. Physiol., Univ. of Oklahoma
DAVIS, Joseph R.: Assoc. Prof. Pharmacol., Loyola Univ., Chicago
DAWSON, William W.: Div. Ophthalmol., Univ. of Florida, Gainesville
DOWNING, S. Evans: Asst. Prof. Pathology, Yale Univ.
DREIFUS, Leonard S.: Asst. Prof. Med., Hahnemann Med. Coll.
DUNCAN, Gordon W.: Sr. Res. Scientist, The Upjohn Co.
EMERSON, Thomas E., Jr.: Dept. Physiol., Univ. of Oklahoma Med. Ctr.
ERICKSON, Robert P.: Asst. Prof. Psychol., Duke Univ.
ESSMAN, Walter B.: Asst. Prof. Psychol., Queens Coll., Flushing, N. Y.
FABIANEK, John S.: Asst. Prof. Biochem., New York Med. Coll.
FINGERMAN, Milton: Prof. Zool., Newcomb Coll. of Tulane Univ.
FRANK, Martin J.: Asst. Prof. Med., New Jersey Coll. Med.
FRANKS, John J.: Asst. Prof. Med., Univ. of Colorado Med. Ctr.
FRAZIER, Donald T.: Physiol. Dept., Univ. of New Mexico Sch. Med.
FRIESEN, Henry G.: Res. Assoc. Med., New Engl. Ctr. Hosp., Boston
FROHLICH, Edward D.: Res. Div., Cleveland Clinic, Cleveland, Ohio
GARDNER, Kenneth D., Jr.: Dept. Med., Stanford Med. Ctr., Palo Alto
GEORGE, Robert: Assoc. Prof. Pharmacol., UCLA
GERGEN, John A.: Asst. Prof. Physiol., Bowman Gray Sch. Med.
GILDENBERG, Philip L.: Dept. Neurophysiol., Temple Univ. Med. Sch.
GOMBOS, Ervin A.: Chief, Renal Res. Lab., VA Hosp., Washington, D. C.
GORSKI, Roger A.: Asst. Prof. Anat., UCLA
GOURAS, Peter: Res. Assoc., Ophthalmol. Br., NIH
GRAIG, Frank A.: Assoc. Att. Phys., Med. Div., Montefiore Hosp.
GROVER, Robert F.: Asst. Prof. Med., Univ. of Colorado
GULYASSY, Paul F.: Asst. Prof. Med., CV Res. Inst., Univ. California
HAGAMEN, Wilbur D.: Assoc. Prof. Anat., Cornell Univ. Med. Coll.
HAMLIN, Robert L.: Asst. Prof. Vet. Physiol., Ohio State Univ.

HARVEY, Rejane M.: Assoc. Prof. Med., Columbia Univ., Coll. P & S
HILLIARD, Jessamine O.: Assoc. Res. Anatomist, UCLA
HOLT, Peter R.: Dept. Med., St. Luke's Hosp., New York
HUGHES, Walter L.: Prof. & Chmn. Physiol., Tufts Med. Sch.
HYDE, Alvin S.: Res. Med. Officer, Wright-Patterson AFB
HYMAN, Edward S.: Assoc. Invest., Touro Res. Inst., New Orleans
JOHANSEN, Kjell: Res. Asst. Prof. Zool., Univ. of Washington
KATZ, Ronald L.: Asst. Prof. Anesthesiol., Columbia Univ.
KENDRICK, John E.: Asst. Prof. Physiol., Univ. of Wisconsin
KILBURN, Kaye H.: Assoc. Prof. Med., Duke Univ. Med. Ctr.
KISSEN, Abbott T.: Res. Physiol., Aerospace Med. Res. Labs.,
Wright-Patterson AFB
KLEMM, William R.: Assoc. Prof. Physiol. & Pharmacol., Iowa State
Univ.
KLOTZ, Arthur P.: Prof. Med., Univ. of Kansas Med. Ctr.
KOCH, Alan R.: Res. Asst. Prof. Physiol., Univ. of Washington
KOLMEN, Samuel N.: Assoc. Prof. Physiol., Univ. of Texas
KORNEL, Ludwig: Assoc. Prof. Med., Univ. of Alabama
LANDAU, Barbara R.: Asst. Prof. Physiol., Univ. of Washington
LEFER, Allan M.: Asst. Prof. Physiol., Univ. of Virginia
LICHTON, Ira J.: Assoc. Prof. Nutrition, Univ. of Hawaii
LINDSAY, Raymond H.: VA Hosp., Birmingham, Ala.
LIPETZ, Leo E.: Assoc. Prof., Inst. Res. Vision, Columbus, Ohio
LOMAX, Peter: Asst. Prof. Pharmacol., UCLA
LUDWIG, George D.: Assoc. Prof. Med., Hosp. of Univ. Pennsylvania
MacLEOD, Robert M.: Asst. Prof. Int. Med., Univ. of Virginia
McGIFF, John C.: Asst. Prof. Med. & Pharmacol., Univ. Pennsylvania
MEIKLE, Thomas H. Jr.: Asst. Prof. Anat., Cornell Univ. Med. Coll.
MEYER, Maurice W.: Assoc. Prof. Dent., Univ. of Minnesota
MOORE, E. Neil: Res. Asst. Prof. Physiol., Univ. of Pennsylvania
MOULTON, David G.: Vis. Assoc. Prof. Physiol., Florida State Univ.
MOUNIB, Mohamed S.: Sr. Scientist, Fisheries Res. Bd. of Canada
MOUSHEGIAN, George: Prof. Physiol. & Psychol., Syracuse Univ.
NAKANO, Jiro: Asst. Prof. Pharmacol., Univ. of Oklahoma
NERI, Rudolph O.: Dept. Physiol. & Biochem., Schering Corp.
NOCENTI, Mero R.: Asst. Prof. Physiol., Columbia Univ.
PEIRCE, Edmund C. II: Assoc. Prof. Physiol.-Surg., Emory Univ.
RABINOWITZ, Lawrence: Asst. Prof. Physiol., Univ. North Carolina
RATNOFF, Oscar D.: Dept. Med., Univ. Hosps., Western Reserve
RECTOR, Floyd C., Jr.: Asst. Prof. Int. Med., Univ. Texas Southwestern
REEVES, Johnie L.: AFSC, Box 329, Andrews AFB, Washington, D. C.
REIS, Donald J.: Asst. Prof. Neurol., Cornell Univ.
RIOPELLE, Arthur J.: Dir., Delta Regional Primate Res. Ctr.
ROWELL, Loring B.: Res. Asst. Prof., Univ. of Washington
SAGAWA, Kiichi: Asst. Prof. Physiol., Univ. of Mississippi
SAUNDERS, Harry L.: Endocrine Sect., Smith Kline & French Labs.
SCHAEPPI, Ulrich: Scientist, Worcester Fndn. for Exptl. Biol.
SCHANKER, Lewis S.: Head, Sect. Biochem. of Drug Action, NHI, NIH
SCHAPIRO, Herbert: Asst. Prof. Anat., Univ. of Tennessee
SCOTT, Jerry B.: Asst. Prof. Physiol., Univ. of Oklahoma Med. Ctr.
SILVER, Lawrence N.: L.I. Jewish Hosp.-Queens Hosp. Ctr, Jamaica, N.Y.
SKINNER, Newman S., Jr.: Lab. CV Physiol., NIH
SLOVITER, Henry A.: Res. Assoc. Prof., Univ. of Pennsylvania

SMITH, Elvin E.: Asst. Prof. Physiol. & Biophys., Univ. of Mississippi
SOBEL, Harry: Chief, Biochem. Aging Res., VA Hosp., Sepulveda, Calif.
STERMAN, Maurice B.: Asst. Res. Anatomist, UCLA
TAKEDA, Yashuhiko: Asst. Prof., Lab. Med., Univ. of Colorado
TAPPER, Daniel N.: Assoc. Prof. Phys. Biol., New York State Vet. Coll.
TIETZ, William J., Jr.: Dept. Rad. Biol., Colorado State Univ.
TRANK, John W.: Asst. Prof. Physiol., Univ. of Kansas
van TIENHOVEN, Ari: Assoc. Prof. Avian Physiol., Cornell Univ.
WALTER, Donald O.: Asst. Res. Anatomist, UCLA
WELLS, Roe E., Jr.: Assoc. in Med., Harvard Med. Sch.
WEST, William L.: Assoc. Prof. Pharmacol., Howard Univ.
WINTER, David L.: Neurophysiologist, Walter Reed Army Inst. Res.
YATVIN, Milton B.: Asst. Prof. Radiobiology, Univ. of Wisconsin
YANOF, Howard M.: Physiology, St. Louis Univ. Med. Sch.

HONORARY MEMBER

KATO, Genichi: Prof. Physiol., Keio Univ. Sch. Med., Tokyo, Japan

ASSOCIATE MEMBERS

CUNNINGHAM, Dorothy J.: Grad. Student, Yale Univ.
DOUGLAS, Donald S.: Dept. Biol. Sciences, George Washington Univ.
DUBNER, Ronald: Oral Med. & Surg., Natl. Inst. Dent. Res., NIH
FILKINS, James P.: Dept. Physiol. & Biophys., Univ. of Tennessee
GOLD, Warren M.: CV Res. Inst., Univ. of California, San Francisco
GOLDSTEIN, Norman N., Jr.: Univ. of California, Berkeley
HAMILTON, Robert W., Jr.: Res. Physiologist, Union Carbide Corp.
HELMAN, Sandy I.: Predoctor. Fellow, Physiol., Marquette Univ.
ISON, Eleanor L.: Asst. Prof. Physiol., Howard Univ.
JOHNSON, Thomas F.: Instr. Physiol., Howard Univ.
McKENNEY, Joel R.: Biol. Scientist, Hanford Labs., Richland, Wash.
MEYER, Frederick R.: Grad. Res. Fellow, Indiana Univ.
O'DRISCOLL, Robert G.: Third Yr. Med. Student, Univ. of Ottawa
ROHRS, Harold C.: Grad. Student, Physiol. & Biophys., Univ. Kentucky
SHERMAN, James H.: Instr. Physiol., Univ. of Michigan
TAYLOR, Stuart R.: Res. Asst., Inst. for Muscle Disease, New York
WILEY, Ronald L.: Grad. Student, Univ. of Kentucky

USE OF AVIAN AND LARGE DOMESTIC ANIMALS IN PHYSIOLOGICAL RESEARCH*

EXPERIMENTAL ANESTHESIA - ELECTRICAL ANESTHESIA IN CATTLE AND SHEEP. Charles E. Short, D.V.M., UT-AEC Agri- cultural Research Laboratory, Oak Ridge, Tennessee.

Unfortunately the design of many animal experiments does not consider adequately the anesthesia and surgery involved in the experimental procedure. In many cases it is apparent that deviations produced by anesthesia and surgery can be sufficient to offset otherwise precise results. It is not always sufficient that the patient is apparently comfortable during an experimental procedure and can be revived at the termination of a given period of study. Neither can we say that accurate results can be achieved where considerable excitement or pain is induced to an unanesthetized patient during the experimental procedure. As we progress into more dignified and accurate approaches to physiological experimentation, it is well to consider the role of anesthesia.

The principal purpose of beginning our investigation of electroanesthesia was to develop and perfect a system of anesthesia in the experimental patient of such nature that the degree of anesthesia could be easily controlled, the effects on the physiological system would be minimum, and the recovery would be rapid and without complication. Various anesthesia agents have known advantages and disadvantages. For experimental purposes these do not always correspond with those for routine, sick or injured patients. Some, for example, may affect blood pressure or cause hemolysis of blood cells, while some experiments are so designed to limit the addition of any chemicals to the patient.

Advances in the use of electroanesthesia indicate its potential in the animal patient. The amount of chemical agents used in conjunction with electroanesthesia has been greatly reduced. At present, many applications are being made with only a light pre-anesthetic and some with no medication. The development of high frequency inductions with low amount of current has eliminated much of the discomfort and excitement of this phase of electroanesthesia.

Studies into the effects of electroanesthesia during prolonged application indicate little adverse affects as reported in "Anesthesia and Analgesia." The recovery phases of electroanesthesia are easily controlled with either immediate or gradual recovery possible at the discretion of the anesthesiologist.

The principal problem at present lies in obtaining the lower planes of anesthesia in some patients. This report concerns alternating sine wave current with frequencies up to 5 k.c.p.s. Other work has been done using other wave forms and types of current at other laboratories.

*Abstracts of papers presented at the Fall meeting Refresher Course, UCLA, Aug. 24, 1965.

In cattle and sheep, electroanesthesia has enabled us to perform many types of surgery. During these procedures, the problem of excess rumen gas formation, anorexia inappetence after surgery, post-operative trauma, shock, and surgical mortalities, especially to patients who are poor surgical risks, have been significantly reduced.

It is most important in experimental procedures where anesthesia is involved to understand the affects that it will have on the patient in order to properly evaluate the data recorded.

THERMOREGULATION IN THE GOAT. Charles C. Gale, University of Washington, Seattle, Washington and Bengt Andersson, Kungl, Veterinärhögskolan, Stockholm, Sweden.

In order to elucidate the role of central "warmth detectors" vs. peripheral cold receptors in the integration of neural and hormonal thermoregulatory mechanisms, local cooling and warming of the preoptic/anterior hypothalamic region ("heat loss center") of unanesthetized goats was performed by water perfusion of chronically implanted thermodes. Most experiments were performed in a neutral room temperature (18° C) with the goats loosely tethered in metabolism cages. Thyroid activation was determined by measurements of plasma PBI¹³¹ levels and of radioactivity over the thyroid gland. Sympathico-adrenomedullary activity was assessed by measurement of urinary excretion of nor-epinephrine and epinephrine.

Cooling of the "heat loss center" invariably produced thyroid and sympathico-adrenomedullary activation concomitant with the development of marked hyperthermia (41.5° C core temperature). The rise in plasma PBI¹³¹ was apparent after 30 minutes, but the steepest rise generally occurred between 30 and 150 minutes after the onset of central cooling. If the preoptic region was cooled for less than 30 minutes, no rise in plasma PBI¹³¹ occurred until after the actual cooling period. When relatively short periods of central cooling (2 to 3 hours) were repeated at intervals of 22 hours, a thyroid response of about the same magnitude was seen each time. During prolonged periods of central cooling, plasma PBI¹³¹ reached a maximum after 4 to 6 hours and then declined, possibly due to accelerated utilization of hormone or to negative feedback. The use of tracer amounts of labeled exogenous T4 and T3 did not indicate accelerated utilization of thyroid hormone during central cooling, but the administration of exogenous T4 (0.5 mg) 2 hours prior to central cooling blocked the thyroidal response.

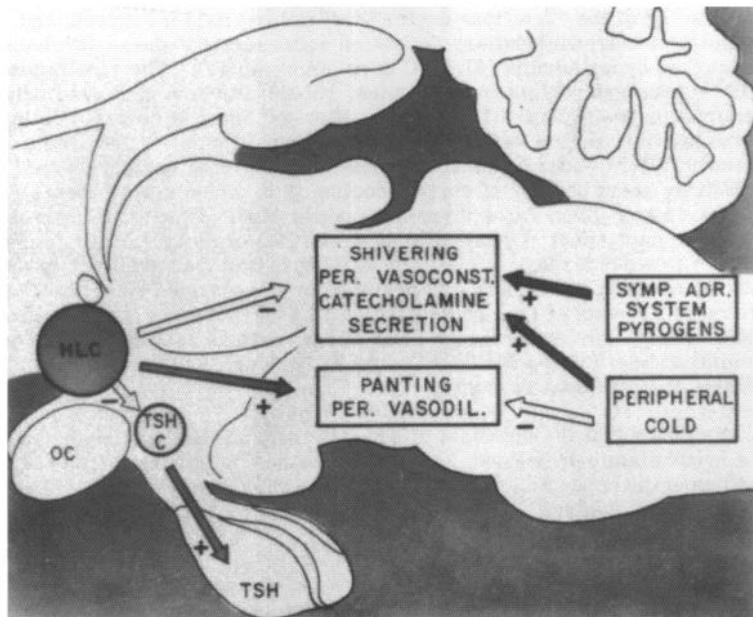
Evidence that the thyroidal effect of central cooling was mediated via the hypothalamic-hypophysial axis was obtained by placing lesions in the median eminence. Following such disconnection of the pituitary from hypothalamic control, cooling of the "heat loss center" failed to cause thyroid activation.

During central cooling urinary excretion of catecholamines was increased, the relative increase of epinephrine being considerably greater than that of nor-epinephrine. In order to evaluate the importance of such sympathetic activity to the thermoregulatory response, a ganglionic

blocking agent (Ecolid) was used. The resulting ganglionic blockade prevented the rise in body temperature normally occurring with central cooling. Also, shivering in response to such cooling was markedly reduced, and instead of the usual rise in urinary catecholamine excretion, these values remained below normal levels. The thyroidal activation obtained by central cooling, however, was not prevented. An intravenous infusion of catecholamines counteracted the ganglionic blockade and resulted in marked shivering and a rise in core temperature.

Local warming of the "heat loss center" influenced the pituitary-thyroid and the sympathico-adrenomedullary systems in the reverse manner to cooling. Such warming blocked the thyroid activation normally occurring during general cold stress induced by administration of large amounts of ice water into the rumen. Similarly, during local warming of the "heat loss center" in a cold (2° C) environment, urinary excretion of catecholamines remained low but increased markedly on cessation of central warming. Both epinephrine and nor-epinephrine excretion rose to high levels if pronounced hypothermia had developed during central warming. With induction of milder hypothermia, the increase was predominantly in nor-epinephrine.

The figure indicates the proposed interaction of peripheral and central mechanisms in thermoregulation.



BEHAVIORAL EXPERIMENTS WITH PIGEONS AND GOATS. Bernice M. Wenzel, School of Medicine, Los Angeles, California.

If the broad principles of behavioral phenomena are to be successfully delineated, then at least a judicious variety of animal forms must be studied. Significant aspects of behavior might be expected to vary with such general conditions as domestication, central neural development, dominant mode of locomotion, relative capacity of different sensory modalities, developmental age at birth, etc.

The use of avian species, especially the pigeon, has not been uncommon in behavioral research, but large domestic mammals have been used infrequently in such experiments. Some of our recent investigations have been conducted with the goat and the pigeon, and can be considered illustrative of certain approaches to working with these animals.

Baldwin, working with Wenzel and Tschirgi, chose the goat for his experiments because of its anomalous cephalic circulation, as well as its behavioral reactivity. The internal carotid artery is nonfunctional, so that access to the common carotid, through chronic skin loops, permits manipulation of the blood supply to the entire brain anterior to the caudal third of the medulla. Various substances were infused into the carotid artery to study the simultaneous effect on cortical EEG and on performance of a learned visual discrimination for brightness or pattern. A 2-minute infusion of 0.1% thiopental, for example, caused a gradual, but pronounced, reduction in rate of work but no increase in errors. At the same time, the EEG often showed spindles characteristic of light barbiturate anesthesia in man.

Pigeons are being used in one phase of continuing studies on the effects of unilateral lesions in the central nervous system on spatial behavior. In collaboration with Tschirgi and Wenzel, Binggeli found that birds with unilateral lesions in the optic tectum learned a complex visual discrimination, involving spatial and spectral characteristics, more rapidly than normal birds. A subsequent study showed that the lesioned birds learned more slowly than normal controls when a vertical, rather than horizontal, spatial discrimination was required, while the task was otherwise identical to that previously used. In the same experiment, retention after one month was also measured, as well as transfer to the horizontal version of the task. Although the lesioned birds were slower in completing all phases than the normal ones, when they transferred to the horizontal task, their learning was faster, relative to their original learning of the vertical task, than that of the controls, compared to their previous learning.

Behavioral investigations do not necessarily involve learning or skeletal muscular responses. A rapprochement between behavioral and organ physiology is approached in a study of the olfactory sense in birds, in which heart rate and respiration are recorded and changes in these measures taken as indices of perception. Different avian species are being studied in an effort to settle the long-standing controversy controversy concerning the functional status of their olfactory structures. The data collected so far from pigeons and shearwaters show definite

responses to odorous stimuli, not only from the heart and the respiratory apparatus but also in the olfactory bulb.

Supported by grants No. G-21521 and GB 1115 from the National Science Foundation, and a grant from the National Association for Mental Health.

ADRENAL-PITUITARY AXIS AND AGING IN CATTLE. Gail D. Riegle and John E. Nellor, Endocrine Research Unit, Michigan State University, East Lansing, Michigan.

The effect of increasing age on pituitary-adrenal function in cattle ranging from 1 month to 15 years of age was estimated by analysis of normal levels of plasma adrenocorticotrophic activity and its diurnal variations; normal concentrations of plasma glucocorticoids; the responsiveness of the adrenal cortex as indicated by the increase in circulating plasma glucocorticoids following ACTH infusion; and the histological changes occurring in the adrenal cortices of the various aged animals. Levels of plasma adrenocorticotrophic activity were consistently low (less than 2.0 mU/100 mls plasma) in cattle from 1 month to 3 years of age. Plasma adrenocorticotrophic activity was found to increase with increasing age (average concentrations from cattle above 3 years of age ranged from 3.9 to 13.0 mU/100 mls plasma). Cattle above 3 years of age had significantly higher quantities of plasma adrenocorticotrophic activity than the younger animals. There were no discernable diurnal variations in plasma adrenocorticotrophic activity in the older cattle. Levels of plasma cortisol and corticosterone were not significantly different with increased age (the average concentration of plasma cortisol was 2.95 micrograms/100 mls and that for corticosterone was .95 micrograms/100 mls plasma). Adrenocortical responsiveness as measured by increased levels of circulating glucocorticoids after ACTH infusion was consistently high in 2 and 3 year old cattle. Adrenocortical responsiveness among the older cattle was lower and more variable ranging from no increase in plasma glucocorticoids to moderate increases in circulating glucocorticoids after ACTH infusion. The histological results indicated that the amount of functional adrenocortical tissue decreases with age. In some of the older cattle there is little cortical tissue remaining, while others maintain considerable amounts. It appears that as some areas of the fasciculata become less active they are replaced by connective tissue leaving nodule-like islands of tissue that appear to remain functional. At latter ages these nodules become atrophic with their peripheral cortical tissue being replaced by connective tissue. There was a positive correlation between the histological evidence of progressive adrenal cortical degeneration and the relative insensitivity to the exogenous ACTH infusions. These data suggest that there is decreased amounts of functional adrenocortical tissue in older cattle, requiring increased amounts of plasma adrenocorticotrophic activity to maintain normal levels of plasma glucocorticoids. The limited functional tissue in older cattle is apparently secreting at nearly maximal capacity since in many aged animals there was no increase in the levels of circulating glucocorticoids following exogenous ACTH infusion.

HIGH ALTITUDE STUDIES IN CATTLE AND SHEEP. Robert F. Grover, John T. Reeves, Donald H. Will, and Estelle B. Grover, University of Colorado School of Medicine, Denver, Colorado.

Whether or not a physiological investigation is productive often depends upon the species of animal selected for study. For example, in an investigation of hypoxic pulmonary vasoconstriction, the ideal experimental animals are cattle because they develop severe pulmonary hypertension at high altitude. We obtained 10 steers from low altitude and maintained them at 12,700 feet for 9 weeks. During the first week, ventilation increased and PaCO_2 decreased. However, this was not sustained, and the animals became more hypoxic. In every animal, pulmonary arterial pressure doubled in two weeks and tripled in six weeks. This hypertension resulted from diffuse narrowing of the small muscular pulmonary arteries. Vasoconstriction was the primary mechanism with medial hypertrophy demonstrable only in the most severely hypertensive animals. Sheep would be particularly unsuitable for the above study because, unlike cattle, they develop no pulmonary hypertension at high altitude. However, sheep are of particular interest for studies of oxygen transport during chronic hypoxia. The hemoglobin of sheep has less affinity for oxygen than the hemoglobin of most other species. At 12,700 feet, animals had a PaO_2 of 40-45 mmHg. The resulting SaO_2 was only 59% in sheep compared with 82% in steers. In spite of this, the steepness of the hemoglobin-oxygen dissociation curve permitted the transport of adequate oxygen with a relatively small decrease in PO_2 , thereby preserving tissue PO_2 . (See *J. Appl. Physiol.* 18: 560-566, 567-574, 1963).

ARTERIAL RECEPTORS OF AVES. Robert K. Ringer and Charles H. McGinnis, Jr., Department of Poultry Science, Michigan State University, East Lansing, Michigan.

Little information is available concerning the physiology of blood pressure regulation by the vasomotor centers, the baroreceptors and the chemoreceptors in the domestic fowl. Drug-induced vasodepression in the chicken is generally accompanied by some degree of heart rate increase and drug-induced vasodepression is accompanied by an associated bradycardia; this provides strong evidence that pressure reflexogenic tissue exists in the fowl. Attempts to elicit the classical carotid sinus reflex on blood pressure by occlusion of, or stimulation of, the area of carotid bifurcation high in the neck region of the chicken comparable to the location of the carotid sinus in mammals have been unsuccessful (Heymans and Neil, "Reflexogenic Areas of the Cardiovascular System," 1958). The area in the chicken homologous to the mammalian carotid sinus area is located on the common carotid arteries rostral to the root of the subclavian artery and posterior to the parathyroid gland (Adams, "Comparative Morphology of the Carotid Body and Carotid Sinus," 1958), within the thoracic cavity. Occlusion of the carotid, vertebral and brachiocephalic arteries was carried out in commercial Leghorn-type hens to determine if functional arterial baroreceptors were located in the head, cervical and carotid sinus regions. Either bilateral vertebral or carotid occlusion produced a slight de-

pression of heart rate and no effect on respiration. The change in blood pressure was not thought to be mediated by baroreceptor reflexes but was attributed to a reduction in the capacity of the cardiovascular system. Occlusion of both carotids and vertebrals elicited a sharp drop in mean cerebral pressure (-64%) followed by a gradual rise in systemic pressure. Mean cerebral pressure rebounded as systemic pressure increased. There was a large, transient decrease in respiratory rate. These changes were considered to be induced by cerebral ischemia. Denervation of the sinus homologue on one side of the chicken was accomplished by cutting the vagus on that side while the contralateral brachiocephalic artery was occluded; thus removing pressure from the sinus area. No significant changes in systemic pressure, heart rate or respiration rate could be attributed to lowering of pressure (-75%) in the intrasinus area. The results indicate that functional baroreceptors are absent in the head, neck and carotid sinus homologue area of the domestic fowl.

VASCULAR CHANGES IN EXPERIMENTAL HYPERTENSION IN SWINE.

R. W. St. Clair, N. H. Booth, and M. L. Hopwood, Department of Physiology, Colorado State University, Fort Collins, Colorado.

Certain metabolic characteristics of swine arterial tissues were evaluated by incubation of arterial slices in a Krebs-Ringer phosphate buffer. Oxygen consumption was determined in a Warburg apparatus, and following a two hour incubation period, glucose utilization and lactic acid production were measured. Using this procedure the metabolic characteristics of normal and hypertensive arterial tissues were evaluated. To produce hypertension, the aortas of seven swine were partially constricted proximal to the origin of the brachiocephalic artery. Six to seven months following the constriction, pressure measurements verified hypertension in the prestenotic area. The influence, on the above parameters, of the sex of the animal as well as the addition of 17 beta estradiol to the incubation media was also studied.

Swine were chosen for this study because of the morphological similarity between spontaneous atherosclerosis in the pig and early arterial lesions in man. The pig also has the advantage of being large enough to provide sufficient amounts of arterial tissue to allow metabolic studies on a number of arterial trunks from the same animal.

In control animals the aorta and pulmonary artery possessed similar metabolic characteristics (considering the parameters studied), while the coronary arteries were less metabolically active. Considering lactic acid to be representative of glycolysis, a calculation of glycolytic energy production revealed that the aorta and pulmonary artery derived approximately 56% of their energy from glycolysis compared with 47% for the coronary arteries.

Hypertensive aortic tissue was found to be more metabolically active than control aortic tissue, while poststenotic aortic tissue, although normotensive, had greatly reduced metabolic capabilities when compared with control aortic tissue. In the poststenotic aorta there was a large dependence of glycolytic energy production (85%). Although the aorta was able

to increase its metabolic capabilities when subjected to hypertension, the coronary arteries (rendered hypertensive by the surgery) were unable to do this. Hypertensive coronary arterial tissue did not differ metabolically from coronary arterial tissue of control animals.

When considering the sex of the animals from which tissues were obtained, arterial tissues from female animals, with the addition of estrogen to the incubation media, exhibited a significant increase in the amount of glycolytic energy production (from 53% to 67%). Influence of the sex of the animal on the arterial wall was suggested by the apparently larger amounts of endogenous substrate present in the vessels of the female animals.

Although it is difficult to draw conclusions relating metabolic data to atherosclerosis, the fact that certain metabolic characteristics of various arterial trunks are not identical, may suggest a basic biochemical origin of arterial disease. This assumption is supported by the knowledge that estrogens and hypertension, factors known to play a role in atherogenesis, can alter certain metabolic characteristics of the arterial wall, and that all arterial trunks do not react in a similar manner.

This investigation was supported (in part) by a Public Health Service Training Grant (Number GM-759) from the (Division of General Medical Sciences) Public Health Service and from National Institutes of Health Grant (Number HE-07160).

DYNAMICS OF THE FETAL LAMB CIRCULATION BEFORE AND AFTER BIRTH. N. S. Assali, T. Kirschbaum, W. Lucas and R. Beck, UCLA Medical Center, Los Angeles, California.

Dynamics of the systemic and pulmonary circulations were investigated in fetal lambs before and after lung expansion and umbilical cord clamping. Under spinal anesthesia, the fetus was marsupialized to the uterine walls to protect umbilical circulation, and breathing prevented by covering fetal head with saline filled glove. Blood flows in ascending aorta, pulmonary artery, ductus arteriosus and main umbilical vein were monitored with electromagnetic flowmeters. Pressures in aorta, pulmonary artery, umbilical vein and the four heart chambers were simultaneously recorded with strain gauges. Blood pO_2 , pCO_2 , and pH were analyzed at frequent intervals. All of these parameters were recorded continuously in the fetal state and during lung ventilation with various gas mixtures. Thereafter, the umbilical cord was clamped and the effects of this procedure were noted.

The findings are as follows: 1) Before lung expansion, right heart pressure, output and work are greater than left; this relation is promptly reversed after lung expansion. 2) Before birth, pressure and resistance in the pulmonary circuit are higher than those in the systemic circuit; after lung expansion, pulmonary pressure and resistance fall markedly while those of the systemic circulation rise. Cord clamping increases

further systemic pressure and resistance. 3) Fetal cardiac output per Kg. of body weight (Aortic flow + Ductus flow) is about three times that of an adult at rest. This high output is related to the presence of various cardiovascular shunts and represents a compensatory mechanism against low oxygen content of fetal blood. Lung expansion and cord clamping reduce fetal cardiac output strikingly. 4) Before birth, blood flow in ductus arteriosus is from right to left, and amounts to about 70% of right ventricular output; dynamically, it is governed by inertial effects; an asynchrony between right and left ventricular ejections also plays a role. After lung expansion, ductus flow becomes left to right and decreases markedly, because of constrictive effects of oxygen on ductus walls. 5) Umbilical blood flow represents 65% of total fetal cardiac output. Lung expansion with air, oxygen or helium reduces umbilical flow through reduction in cardiac output.

In summary, the fetal circulation is characterized by a: 1) functional dominance of the right side of the heart; 2) high pulmonary vascular resistance which is related not only to the unexpanded alveoli but also to an active vasomotor tone in pulmonary vessels; 3) high cardiac output related to presence of vascular shunts and to low oxygen content of fetal blood; and 4) low resistance system of umbilico-placental circulation which absorbs 65% of total cardiac output. Lung expansion and cord clamping lead to various readjustments in systemic, pulmonary and regional flows and resistances during which the left ventricle begins to dominate, the shunts close, the cardiac output decreases and the pattern of adult circulation slowly emerges.



ANIMAL BEHAVIOR SOCIETY

The Animal Behavior Society was organized December 28, 1964, at Montreal, Canada, and incorporated in August 1965 at Urbana, Illinois. Its objectives are to promote and encourage the biological study of animal behavior in the broadest sense, using both descriptive and experimental methods under natural and controlled conditions. The Society is an outgrowth of, and maintains official affiliation with, the Section of Animal Behavior and Sociobiology of the Ecological Society of America and the Division of Animal Behavior of the American Society of Zoologists. The Behavior Society now has formal liaison arrangements with the American Psychological Association, American Society of Ichthyologists, the Society of Biological Psychiatry, and the Wildlife Society. It is hoped to establish increasingly close relations with the American Physiological Society in the form of symposia on topics of mutual interest and in shared membership. "Animal Behaviour" serves as the publication outlet for the Society. The number of charter members exceeds 550.

PAST-PRESIDENT'S ADDRESS

A Bicycle in the Age of Jets

J. R. PAPPENHEIMER

Seventeen years ago the Past-President's address was an innovation; now it has become a tradition and I might add something of a hurdle which every Past-President must overcome before graduating from Council. Perhaps we can call it an oral examination with self-imposed questions. Sir Joseph Barcroft once told me a story about an oral examination in which he asked the student, "...What do you know about the physiology of urea?" "Well, Sir," replied the student, "there is an external ear, a middle ear and an inner ear....." Sir Joseph didn't hesitate a moment; he went right on to examine the student on the physiology of audition.

The title of my talk sounds frivolous for a professional gathering such as this, but it is, of course, symbolic and as an Irish colleague in a field distantly removed from ours once said, "I don't see why the laity should get all the gayety."

Each day I pedal a bicycle some eight miles back and forth between Cambridge and the Medical School in Boston. The route follows the Charles River most of the way and a few years ago Paul Dudley White persuaded the Commonwealth to designate the sidewalk as an official bicycle path. Inauguration of this path was a gala affair. We pedalled a message from the Mayor of Cambridge to the Governor at the State House in Boston and we were followed by a bevy of Radcliffe girls on bicycles and by publicity men in open Cadillacs, armed with television cameras.

On the bicycle path there is no traffic problem and I must confess to a certain sadistic pleasure in passing the automobiles, which crawl forward, inch by inch, bumper to bumper, on the adjacent roadway, like so many red blood corpuscles trying to move through a narrow capillary. In spring and fall the eight-oared shells are out on the river; I can just keep pace with them to participate vicariously in a sport which I enjoyed 30 years ago. In winter the going sometimes gets a bit chilly but my wife made me a woolen hat, effective as it is handsome; certain residents of Cambridge claim that they can tell the outdoor temperature by the position of this hat relative to my auditory meatus.

Some people say that they can think better when they are walking or when they are revved up to 72 rpm at 2-3 Mets: the "peripatetic philosopher" of Oliver Wendell Holmes refers to Aristotle's habit of walking as he lectured. At any rate the relations between ultrafiltration, diffusion and pore size became clear to me half way between Magazine Beach and the River Street Boat Club.

Many material benefits derive from this daily bicycle trip. You would be surprised at the amount of salvage which can be picked up along the roadside-- gloves, handkerchiefs, loose change and once even a well-preserved turkey out of somebody's station wagon, dressed and ready

for the oven. I would like to think that our evening cocktail is paid for by money saved on gasoline, but as a physiologist I am compelled to admit that mile for mile the extra food required for propelling a bicycle exceeds in cost the gasoline requirement of my 1948 Jeep.

Half-way between the Cottage Farm Bridge and the Medical School there is a park and here a little path leads to Mason's Pond. The pond is surrounded by willow trees which hide completely the nearby buildings. On high pressure days, when deadlines seem impossible to meet, or when I have to catch the noon jet for a committee meeting 3000 miles distant, I dismount at Mason's Pond to spend a few sane moments watching the ducklings swim behind their mothers and I try to reconcile a two-wheeled philosophy to the world of jets.

Surely there is much to reconcile. The social, political and cultural paradoxes created by technology meet us at every turn. The Jet, so complex and so beautiful, represents a supreme triumph of our collective technologies -- but beware, lest it steal from you the very time it was designed to save. Nuclear Deterrence and Disarmament; Conquest of Disease and the Population Explosion; Automation and Unemployment; Medical Technology and the Prolongation of Suffering; Scientific Agriculture and the Destruction of Natural Resources; these are but a few of the great paradoxes brought upon us by the flowering of science. Even within the tiny realm of physiology we have some conflicts to resolve. Judging by the growth and vigorous activity of the American Physiological Society I think we can say that physiology is in no immediate danger of becoming extinct; nevertheless we would be insensitive indeed if we failed to note that the role of physiology in relation to biology and medicine is changing rapidly.

Only 25 years ago physiology was the chief discipline dealing with functional aspects of life processes. It was generally regarded as a single discipline, having deep roots in the past and sufficient unity to mark it as a cornerstone in the educational foundation for experimental biology or medicine. It was assumed, strange as it may seem today, that anyone on the faculty of a medical school would have at least an elementary knowledge of the integrative functions of vertebrates, such as breathing, circulation of the blood, sensation, motility, reproduction or temperature regulation. Graduate students in any one of the pre-clinical sciences automatically took a course in physiology as a required part of their predoctoral training. The professor of physiology was expected to give all or most of the lectures and his instructors groomed themselves to do likewise. Within physiology there were no separate societies or journals devoted to biophysics, neurophysiology, endocrinology, nephrology, or respiratory physiology...not to mention the physiology of artificial organs. Twenty-five years ago the International Congress of Physiology served the needs of biochemistry, pharmacology, biophysics and nutrition and *Physiological Reviews* was the principal review journal for all these fields. A scant 15 years ago there were no journals of Molecular Biology, Neurochemistry, Molecular, Neuro- or Biochemical Pharmacology, Lipid Research or Biophysical Cytology: these hybrid additions to functional biology were born in the age of the Jet and they are having extremely important effects on physiology in

relation to biology and medicine.

Beginning only a few years ago, graduate students in biochemistry, microbiology and anatomy began to believe, rightly or wrongly, that the subject matter of classical physiology is not directly related to their planned life's work on molecular interactions and ultrastructure. Indeed, the shoe is now on the other foot and students of integrative function are much more interested in learning about ultrastructure and molecular biology. As the new generation of biochemists, microbiologists and anatomists begin to assume responsibility for teaching it is perfectly natural for them to question the relevance of integrative physiology - a science to which they have not been exposed and which serves no obvious role in their own research. Some of the effects of this situation were described very tactfully by Dr. Forster in the report of his tour as Councilman to various new departments of physiology. ".... there is a general tendency," he said, "to decrease the number of topics covered in the medical school physiology courses and to increase the detailed consideration of areas in other sciences pertinent to each topic." Being Past-President, rather than President-Elect, perhaps I can afford to be more blunt. What Dr. Forster really meant to say was the following:-

"There is a tendency among some of our colleagues in related fields to think of physiology as a sort of functional gross anatomy, parts of which have to be exhumed annually for the benefit of first year medical students, but moribund in terms of contemporary research."

Now I can see that Dr. Forster is getting nervous and I will admit my translation may have been a bit free. Nevertheless, the trends are real. At some medical schools the classical subject matter of physiology has already been partitioned between so many ancillary sciences that physiology as a discipline has almost lost its identity. The teaching of each topic is carried out by a kind of educational saturation bombing. Waves of specialists take off briefly from their various research laboratories to unload their special knowledge of each topic on the students before returning safely to base. Gone are the days when the professor gave all the lectures and every instructor was at least theoretically capable of passing a student examination in something called physiology.

Perhaps this fragmentation is inevitable and we should no longer think of physiology as a unified body of knowledge with a continuing future of its own. Having raised this dreadful question I suppose I shall have to try to answer it and I am reminded of the remark made by a stern professor to an overconfident examinee. "Young man", he said, "you may think you're in shallow water, but you're sinking fast."

I would admit at the outset that progress in physiology has been slow in comparison with developments occurring in the hybrid sciences. Recent advances in knowledge of cellular metabolism, ultrastructure and molecular genetics are enormously exciting and they open up new horizons for all of biology, including physiology. At this time we can look forward to understanding the molecular basis of learning itself and it is not too much to imagine that the tedious process of acquiring knowledge

through study will some day be replaced by the intravenous injection of synthetic codons. A contemporary seminar in protein synthesis and gene replication would be utterly incomprehensible to the biochemist of only 20 years ago. In contrast, it would not take us long to bring Cannon or Starling or Haldane or Sherrington up to date in physiology. Indeed, we could go back still another generation. Bernstein with his command of classical thermodynamics and field theory, would be quick to grasp the ionic basis of biological potentials. Elliott would take instant delight in nor-epinephrine and Christian Bohr would be able to assimilate quickly our contemporary concepts of gas exchange. The Textbook of Physiology edited by E. A. Schäfer in 1898 covers much of the general territory we expect to find in a 1965 textbook, the most notable omission being endocrinology.

I do not mean to imply that significant progress has not been made during the past 70 years; rather, I am trying to emphasize that physiology, unlike some of its younger sister sciences, is based on a well-established body of knowledge; progress is slow but continuous and the student must travel further through cultivated pastures before reaching the frontiers. In the poetic words of Sir Michael Foster, "What we are is in part only of our own making, the greater part of ourselves has come down to us from the past. What we know and what we think is not a new fountain gushing fresh from the barren rock of the unknown at the stroke of the rod of our own intellect: it is a stream which flows by us and through us, fed by the far off rivulets of long ago."

Our Society is well aware of this heritage which for us has personal as well as scientific meaning. As Walter Cannon once put it, "I am the son of Bowditch who led me into physiological investigations. Dr. Bowditch, in turn, was the son of Karl Ludwig. Through my grandfather Ludwig, I am related to the Italian physiologist Mosso, and the Russian physiologist Pavlov. In my own place in this sequence of familial relationship, I have many sons and grandsons."

This sense of continuity with the past, the concept of progressive growth based on two, three or more generations of accumulated knowledge, has little meaning for the molecular biologist of today: nor is it likely to capture the imagination of the public which is educated through the press and through the medium of advertising to think of science in terms of an unending series of breakthroughs. The word "breakthrough" is an expressive military metaphor which came into vogue after World War II; it is usually prefaced by an adjective such as significant, major, dramatic, spectacular, or historic. A complete glossary of these and similar phrases will be found in the report of the President's Commission on Heart Disease, Cancer and Stroke. But I must not be too satirical for I, too, would like to make a "breakthrough" some day, even if it were only called minor. The appeal of newness, even if you only think it new, is universal and a strong motivation for us all. Claude Bernard, who in some ways epitomized the adolescence of our own science, expressed this romantically as follows:-

"He who has not experienced the torments of the unknown must be ignorant of the joys of discovery. But by a caprice of our nature, this

joy of discovery disappears the moment it is found. It is only a brief flash which illuminates new horizons toward which our insatiable curiosity carries us with renewed ardor. It is this characteristic of science which makes the known lose its attraction while the unknown is always full of charms." ("C'est ce qui fait dans la science même, le connu perd son attrait, tandis que l'inconnu est toujours pleins des charmes").

Please note that science is feminine, a fact which brings to mind a story which Corneille Heymans told me. ... He was in London for a lecture before the Physiological Society and being a French-speaking Belgian he wasn't quite sure whether he should refer to physiology as He, She, or It. So he went to Lovatt Evans with his problem. Evans looked at him gravely and asked "What time is your lecture?" "Three o'clock" Heymans replied. "Ah" said Evans, "in that case it doesn't matter. The British never think about sex until after five."

A two-wheeled philosophy requires a certain sense of balance and I would temper the romanticism of a Claude Bernard with the wisdom of a Michael Foster. For me, at least, the frontiers of physiology only have meaning when considered in relation to the civilized territories which lie behind. How else indeed can the frontier be recognized? Let me illustrate by an example:-

Today we think of neuromuscular transmission in terms of the discharge of packets of transmitter substance from presynaptic vesicles across the 200A gap to the end-plate membrane. And the discharge of each packet may give rise to miniature end-plate potentials, many of which can sum, under suitable conditions, to produce the graded changes in membrane conductance which lead to excitation. This image of sub-microscopic events is based on superb electron micrographs and upon sophisticated electrophysiological techniques. But I do not think that the significance of the picture can be appreciated without knowledge of the past. Each of us may come to the frontier by slightly different routes but I would begin perhaps with G. H. Parker's work in the 1890's on neurohumoral control of melanophores, proceeding thence to Elliott's bold note of 1904 suggesting that sympathetic nerves might act by releasing adrenaline from their endings. Then a long period of dissent until the 1920's and the beautiful experiments of Loewi and of Cannon which need no comment here. Then to the 1930's which might be called the golden age of A. Ch. or the age of Sir Henry Dale. Nor would I neglect my favorite paper of Feldberg's, dated 1935, in which he estimated the number of molecules of A. Ch. released per nerve impulse from pre-ganglionic fibers. The next big steps came in the late 1940's and early 50's when the development of microelectrodes and stable high impedance DC amplifiers allowed Eccles, Kuffler, Katz and others to explore end-plate potentials. Only then did the electrical phenomena begin to dovetail with the chemical findings and we saw the replacement of all-or-none philosophy with the concept of graded endplate potentials and their interpretation in terms of ion conductance and the action of transmitters on permeability. Thus was the stage set for the entrance of the electron microscope and the visualization of synaptic vesicles and synaptic clefts in the late 50's and early 60's.

A similar sequential development lies behind almost every sector of our frontier and it seems to me that much of the enjoyment of our science comes from this three dimensional approach. Almost 30 years ago I was fortunate enough to take the Part II Honors course in physiology at Cambridge, England. This was full-time physiology for a year and the course consisted of one lecture each day followed by reading, reading, reading, and more reading. There was relatively little laboratory work and what there was I have mostly forgotten. But we came to know the classical literature of three languages, leading up to the then frontiers in almost all sectors of physiology. I have been everlastingly grateful for this period of intensive study. It provided a framework for subsequent research and teaching and made possible the enjoyment of continued reading in fields outside one's own narrow research interests of the moment. A command of the classical literature is perhaps the best single answer to the problems of specialization and fragmentation. It is at least a partial protection from the information explosion. The experience of Part II left one with an internal and immediately accessible store of knowledge of significant papers of the past - in effect one's own personal computer to help separate the original from the repetitious among the vast array of monthly titles.

There are, after all, not so many significant papers when significance is judged in terms of conceptual advances applicable for even a few years. As an order of magnitude one might think of 20-50 papers in each of a dozen or more major areas of classical physiology. We might end up with a total of 500. Certainly, any attempt to make a specific list for widespread distribution would be disastrous, for significance is in the mind of the professor as beauty lies in the eye of the beholder and the transmission of our heritage cannot be left to a mimeograph machine. 500 papers or even a thousand is not an unmanageably large number to store away in one's cortex, given inspiration and the opportunity to study. Conductors, composers and performers of music are likely to have astonishing mastery of the musical literature of the past 200 years and this knowledge is an integral part of their creative and interpretive powers. My friends in history tell me that about 10 years of intensive reading are ordinarily needed to acquire the background for original work in this field. I would not go so far in physiology, but I suggest that scholarship in science is a desirable goal in itself, quite apart from its effects in improving the quality of research.

I hope that I have said enough to convey my feeling that there is more to science than research. In physiology, as in physics, there is a stable body of knowledge, challenging in its own right and just as important for future generations as it was for the generations of 25, 50 or, in the case of physics, more than 100 years ago. Newtonian mechanics send our rockets to the moon. Good teachers will always embellish the old with the new, for this is the secret of inspiring the young; nevertheless, much of physiology and perhaps parts of biochemistry have reached a stage of maturity where worship of the new should no longer dominate our thinking to the extent demanded by our present scientific society.

Finally, I come to the relations between molecular or cellular biology and integrative physiology. The problems I have raised are by

no means confined to mammalian physiology in medical schools; similar problems were discussed only last week by members of the Society of Plant Physiology at the AIBS meetings and in many departments of biology there is a growing sense of imbalance between the integrative and the molecular approach.

The unquestioned advances in molecular biology attract both student interest and financial support and these, in turn, recycle to shape the development of our curricula and research according to the popular sense of what is momentarily important. I believe that this is shortsighted and transient. A productive balance between the various approaches is nowhere better exemplified than in Bayliss' great book on the "Principles of General Physiology". But Bayliss lived at a time when the development of science was almost uninfluenced by the public. The understanding of molecular events is crucial to the whole, but it will never solve the problems of integrative function which are ultimately most exciting to the physiologist. Nor can I imagine a rational approach to animal biology, including medicine and human ecology, which does not depend upon a thorough, general knowledge of integrative physiology.

And now it is time to leave the ducklings on Mason's Pond, hop on the old two-wheeler and get back to work. I have not answered the question concerning fragmentation of physiology and its future relation to biology and medicine in the age of Jets. But at least I have stated my preference and have bared my soul as a Past-President should on this occasion.

Let me thank you for the honor which you did me in electing me President last year. The bicycle has only gone 15,000 miles so far and it may be good for another 15,000. At any rate I intend to come to meetings for another 20 years or so, occasionally putting in my 10 minutes' worth to describe a minor breakthrough. Experience on Council has only added to my respect and enthusiasm for the aims of this Society and for the unselfish manner in which our elected officers, our committees and our professional staff work to carry out these aims. As individual members we receive from the Society more than we give and the Society as a whole contributes substantially to the scientific strength of the nation and to physiology everywhere. For this reason I am ready to start over, to serve the Society in any way future Councils think fit. And I hope you will too.

INEXPENSIVE ISOTONIC MUSCLE LEVER FOR ELECTRONIC RECORDING

Robert E. Henshaw, Gerald R. Walters, and John Fisher
Department of Physiology, University of Iowa

For many physiology laboratory experiments an isotonic muscle lever is the transducer of choice. A variety of levers are commercially available for use with kymographs; however no rugged and inexpensive isotonic lever is yet available for use with electronic recorders. The following isotonic lever is rugged and simple enough for student use. It was constructed with hand tools from commercially available parts and materials for about \$20. Damage can be repaired rapidly by an unskilled laboratory technician.

Principle of Operation

A very light aluminum lever pivots at its center (Fig. 1).

ISOTONIC MUSCLE LEVER FOR USE WITH STRAIN GAGE OSCILLOGRAPHS.

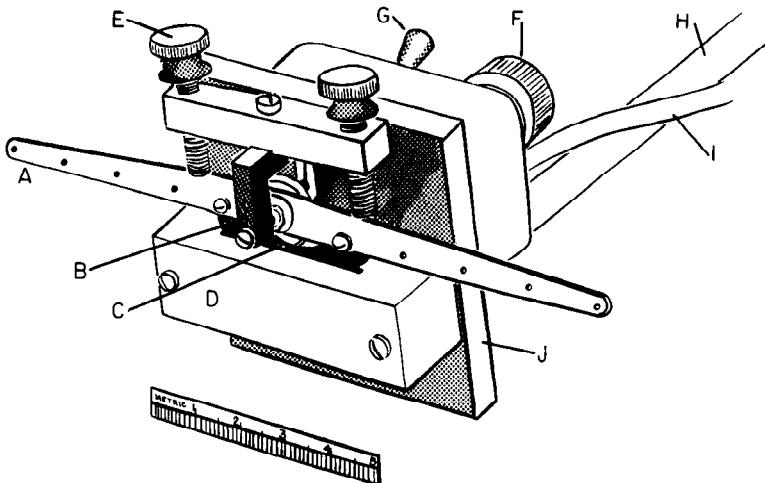


Fig. 1. A: lever; B: yoke/pulley assembly; C: semi-circular resistance strip; D: mercury well; E: after-loading screw; F: balancing potentiometer; G: off/high/low sensitivity switch; H: support rod; I: power cable; J: aluminum plate.

Concentrically attached to the lever around the fulcrum is an exposed resistance strip which dips through a bath of mercury. Movement of the lever causes a greater or lesser portion of the resistor to be shorted out by the mercury, varying the electrical resistance between the mercury contact and the exposed end of the resistor. This variable, which is a function of lever displacement, is incorporated into a conventional Wheatstone bridge circuit. The transducer can be used with most common AC or DC strain gage amplifiers.

Construction

The basic part of this transducer is a small pulley mounted on metal bearings in a yoke 1, with a lever of 0.5 mm thick aluminum rigidly attached to the threaded shank of the pulley (Fig. 2). The semicircular electrical resistance element which is fastened to the lever may be bought commercially 2, or, alternately, hand made in the following way.

ENLARGED VIEW OF LEVER/YOKE ASSEMBLY.

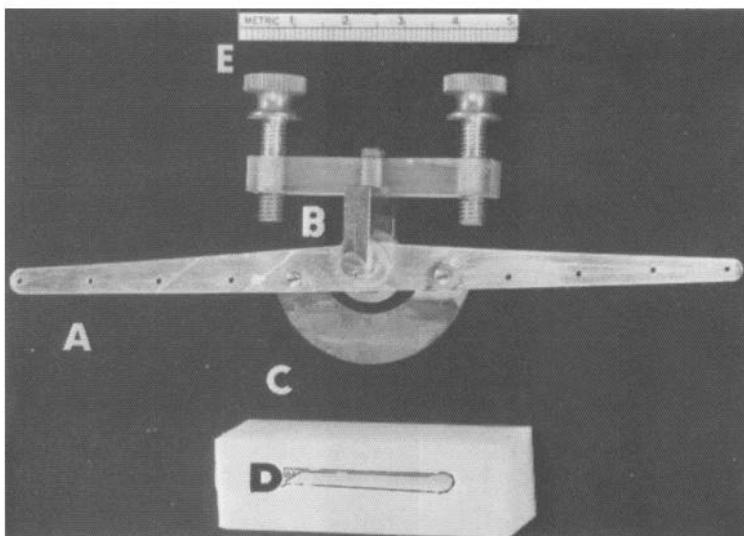


Fig. 2. Labels as in Fig. 1.

¹ Harvard Apparatus Company, Dover, Mass.; light pulley, part number 233.

² International Resistor Company, Boone Division, P. O. Box 393, Boone, N. C.; Special concentric resistance elements per Bulletin T-1A.

A semicircle of 1/16th inch thick Plexiglas is painted on both sides to within 1/2 cm of each end with a carbon particle suspension in lacquer.³ (A carbon coating is required because mercury will attack most high resistance metals; mercury is the only non-wetting fluid contact.) One end of the semicircle is dipped into silver conducting paint to a depth overlapping the carbon lacquer coating, thus providing electrical contact between the aluminum lever and the resistance paint. The opposite end of the resistor was left unpainted so that no electrical contact was made to the lever. Since the semicircular resistance strip pivots about its center, it remains at a constant depth in the mercury, eliminating buoyancy as a force for the muscle to overcome.

The mercury well is a plastic block with a milled slot. A screw through the wall makes electrical contact with the mercury and serves as a binding post (point B in Fig. 3). After-loading screws are attached to the yoke above the lever.

The basic lever system is complete with the well and yoke mounted on a piece of 6 mm thick aluminum and the assembly attached to a 12 mm diameter aluminum rod. For greatest convenience the Wheatstone bridge circuit (Fig. 3), which includes a 1/2 inch diameter potentiometer⁴ and an off/high/low sensitivity switch, is housed in a small box attached to the transducer. No dimensions are critical, and therefore none are specified here.

Performance

Output voltage for displacement (at tip of lever): 20 mV/V/cm;

Resolution: less than 1 mm displacement;

Frequency response: flat to 4 cycles per second;

70% of full scale at 5 cycles per second;

resonant frequency: 6.5 cycles per second;

Temperature sensitivity and baseline drift: compatible with needs for student laboratories;

Weight of lever, resistor, and pulley: 4 gms.

³ General Cement Manufacturing Company, Rockford, Ill.; Television Tube Koat, number 49-2; probably available at local television repair shops. One or two coats are applied with a soft brush; the thicker the coat, the lower the resistance.

⁴ Lafayette Radio Electronics Company, 111 Jericho Turnpike, Soyosset, L.I., N.Y.; "dime-sized potentiometers".

SCHEMATIC OF CIRCUIT OF ISOTONIC LEVER.

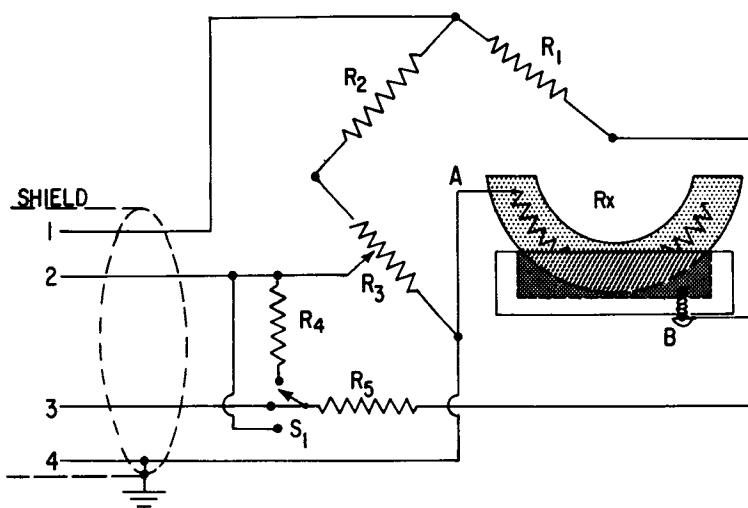


Fig. 3. R_1 : 1500 to 3000 ohms (depends on size of R_x and thickness of resistance lacquer); R_2 : 27,000 ohms; R_3 : 5000 ohms linear taper potentiometer; R_4 : 4700 ohms; R_5 : 10,000 ohms (combination of R_4 and R_5 give a 10:1 reduction in output voltage when used with a Gilson Minipolygraph. Values may need to be adjusted for other recorders.). S_1 : SPDT (on-off-on) switch. A: contact through bearing between lever and yoke; B: brass screw contact into mercury. #1, #2: excitation voltage; #3, #4: output voltage.

Comments

Two disadvantages of this lever should be noted: mercury is messy and potentially poisonous; and mercury oxidizes readily and the floating oxide can foul the resistance element. To reduce mercury problems, the well holds only one milliliter of mercury, and very little surface is exposed. Spillage occurs only with a hard jolt or tilting the well. If the resistance element and the well are rinsed with dilute HCl and air-dried before use, and if clean mercury is always used, fouling is minimized. Mercury usually can be cleaned adequately by passing it through a filter paper in which several holes have been punched with a needle. Dilute HCl dissolves most floating debris. Mercury must be dry before being placed in the transducer well.

The advantages of this lever offset its disadvantages. Beginning students understand the principle of the transducer, and are not confused by complex electronics. With the student controlling sensitivity and balancing at the transducer, several muscle preparations can be

studied simultaneously with a single multichannel recorder. For instance, paired data may be obtained from the right and left frog gastrocnemii with increasing loads on one muscle and decreasing loads on the other. The lever is rugged, and if damaged, it is easily repaired with hand tools. It is submitted as a useful adjunct to modern teaching equipment.



CONGRESS OF RADIATION RESEARCH

The Third International Congress of Radiation Research will be held in Cortina d'Ampezzo (Belluno) Italy, June 26 to July 2, 1966, under the auspices of the International Association for Radiation Research. The Congress will be concerned with the physical, chemical and biological effects of ionizing radiations as they interact with living organisms, especially at the cellular and subcellular levels. Further information about the Congress may be obtained from Dr. G. Silini, Secretary-General, Third International Congress of Radiation Research, Casella Postale 2359, Rome A-D, Italy.

GERONTOLOGY CONGRESS

The 7th International Congress of Gerontology will meet at the Vienna Hofburg (Imperial Castle) from June 26 to July 2, 1966. W. Doberauer of Vienna University will be President of the Congress. Open papers may be submitted on any gerontological subject before December 15, 1965. For further information write:

Sekretariat
7 Internationaler Kongress fur Gerontologie
(Mrs. Ingrid Andersons)
Wiener Medizinische Akademie
Alser Strasse 4, Vienna IX, Austria

NEWS ITEMS FROM SENIOR PHYSIOLOGISTS*

Robert K. S. Lim continues his research in an interesting field - the physiology and pharmacology of pain. Not being required to undertake any routine assignments, his laboratory can devote full time to basic problems although the stimulation of teaching and contact with colleagues in other disciplines is lacking.

Joe Wearn is busy as a consultant to the Harvard Medical School and to Western Reserve Medical School with an occasional job at other schools.

K. K. Chen has been serving as professor of pharmacology at Indiana University School of Medicine. He participates in the teaching of the second year medical students and graduates. His research deals with cardiac sterols; one of his students has just obtained his Ph. D. degree. He has had five post-doctorates working with him.

Charles Darrow continues with his research on EEG phase relationships to physiological responses to stimulation; this is providing most exciting results.

Since 1952 Percival Bailey has been Director of Research in the Department of Mental Health, State of Illinois, and intends to remain in that position.

E. J. Van Liere's new edition of "Hypoxia" has been well received, and the reviews have been quite satisfactory. Some of the reviewers wanted more clinical interpretation, but if this had been attempted the monograph would have been far too long. It is having a good sale for a highly specialized monograph.

A. Baird Hastings writes: "The year just past has been a busy one for me both in the laboratory and without. In my laboratory at the Scripps Clinic and Research Foundation, we have been intensively studying the effect of varying CO₂ concentration at constant pH on both carbohydrate and lipid metabolism in liver. This has turned out to be the most exciting research activity I have ever participated in. For extracurricular fun, I have participated in a symposium on metabolism, served on the National Research Council Medical Science Executive Committee, been appointed Chairman of the Division of Medical Sciences of AAAS, and have served as Master of Ceremonies at the launching of Prof. Per Scholander's sea-going laboratory, the "Alpha Helix," a member of the fleet of the Scripps Institution of Oceanography."

Since his retirement in 1959 from the Dept. of Physiology, School of Medicine, University of Maryland, William R. Amberson has been working at the Marine Biological Laboratory, Woods Hole, Mass. under

*Submitted in response to an inquiry in August 1965 by the Committee on Senior Physiologists.

the auspices of the National Institutes of Health. He has been engaged in electrophoretic studies of protein-protein complex formation in extracts of vertebrate skeletal and heart muscles. The major advance has been the discovery that muscle enzymes form complexes with the fibrous proteins. This observation has led to studies of the activities of the glycolytic enzymes in muscle press juices, obtained by the ultracentrifugation of whole muscles. It has been found that at least half of these enzymes is normally attached to the ultrastructure, and is not freely dissolved in the liquid sarcoplasmic matrix as has long been believed. The electrophoretic patterns suggest that the attachment is mainly to the fibrous proteins of the myofibrils. If the muscles are minced the glycolytic enzymes are released. Further observations have been made concerning the significance of the fibrous delta protein, discovered in Baltimore in 1951. It may be acting as a template to bind enzymes to the fibrous proteins myosin and actomyosin. The patterns clearly show the presence of complexes formed by the union of enzymes with myosin and delta protein, in the absence of actin.

David Marine has become interested in local archeology but despite his efforts has not been able to keep ahead of the bulldozer.

After retirement in 1961 Ruth Conklin gave an Adult Education Course in Physiology for three years, using the resources of the Vassar Department. In November 1964, she commenced a three-month trip around the world which included England, Czechoslovakia, India, Bangkok, Hong-Kong and Japan, during which she attended the Physiological Society Meeting at Mill Hill, London, as the guest of a former colleague, Dr. Audrey Smith. Former colleagues and students in many countries made the trip delightful and memorable.

E. S. Nasset has accepted a visiting professorship at George Washington University, Medical School, Dept. of Physiology, beginning January 1, 1966. He gave a paper at the Tokyo Congress and received an honorary Doctor of Medical Sciences degree from Soo Do Medical College, Seoul, Korea on 23 September 1965.

Wallace Fenn writes: "Strictly speaking I have not yet retired although I am seven years past the regular retirement age of 65. I was asked to serve as Director of the Space Science Center of the University probably because I was the only senior member of the faculty who seemed to have nothing special to do after resigning as Chairman of the Department in 1959. As Secretary-General of the International Union of Physiological Sciences and co-editor of Section III of the Handbook of Physiology and with a minimal amount of teaching I have kept thoroughly occupied with nearly half time left over for research work. All things considered I do not believe that I am in the market for another job just yet. I am also looking forward to a lot of responsibility for the success of the 1968 International Congress. In 1969 I shall probably be ready to begin another job."

Thorne Carpenter was delighted to see the photo of Dill, Hall, Talbott and the Consolazio brothers in The Physiologist. He gets a great deal of enjoyment out of reading The Physiologist. The fourth edition of his

book of Tables has been reprinted and a publishing firm in East Germany has obtained permission from the Carnegie people to translate it into German.

Maurice Tainter is continuing with Sterling Drug Inc. and has no immediate plans for retirement.

Charles W. Shilling, retired Captain in the Medical Corps of the Navy, is at present Director of the Biological Sciences Communication Project of George Washington University. The project's primary interest is in studying the problems concerned with the flow of scientific information from the individual who produces it to the one who uses it. Improving the flow of scientific information is one of the crucial problems in the entire field of research.

After retirement at Temple University in 1954, A. E. Livingston became Co-ordinator of Laboratories for St. Johns University; he retired again in 1962. He has thought some of an animal research job in Philadelphia or nearby should such be available.

Henry S. Forbes is Chairman of the Committee on Alaskan Policy of the Association on American Indian Affairs, Inc. The AAIA gives technical assistance - legal, community planning, etc. on request and is now raising an Oliver La Farge Indian Fund to carry on this work. He adds, "If you know of anyone that might be interested I can furnish more details."

Hal Davis became Director Emeritus of Research at Central Institute for the Deaf and also Professor Emeritus of Physiology and Research Professor Emeritus in Otolaryngology at Washington University, all as of July 1, 1965. He continues as Research Associate at Central Institute for the Deaf. He has an active program and some time in the next three or four years will start writing a book on the Physiology of the Auditory System.

Walter Miles writes, "I was 80 on my last birthday and I plan to turn in my "card" come October 1, 1965. I began work here October 21, 1957. I think it only right and proper that the laboratory, which has now become a part of the U.S. Naval Submarine Medical Center should have a senior scientist with the fresh vigorous point of view of a man of 60 to 65 years. Perhaps you have a suggestion for a successor."

Jacob Sacks spent six months in El Salvador in 1960 organizing the biochemistry department of the medical school and went back the following summer to teach biochemistry. He may spend the 1966-67 academic year in Ecuador on a Fulbright lectureship.

Stuart Mudd writes: "The six years since my "retirement" as Professor of microbiology, University of Pennsylvania, have been scientifically the most satisfactory and productive of my life. As Chief of the Microbiologic Research Program, U.S.V.A. Hospital, Philadelphia, I direct a research program on the bacterial and immunochemistry of *Staphylococcus avre*, which has produced some twenty technical papers

and five reviews. As Vice President of the World Academy of Art and Science, I am active in their publications, conferences and in the initiating stages of a World University."

Leslie Kilborn writes: "I was 31 years in China, at the West China Union University (1921-52) trying to build up the medical school of that university, almost from scratch until it was first-rate. There I occupied various posts from Instructor to Professor of physiology and pharmacology, and Dean of medicine, and then Director of the College of Medicine and Dentistry. In 1952, after the beginning of the communist regime, it was no longer possible to continue my work in Chengtu. In Hong Kong (University of Hong Kong) I accepted the Chair of Physiology from 1952-1960. After reaching the age of retirement in 1960 I became Vice-President of Chung Chi College (a College of Arts and Science) and helped in the establishment of a new Chinese University of Hong Kong, through the federation of three colleges (Chung Chi, New Asia and United). I held this post until November 1963, but am now retired and living in Guelph, Ontario." He was awarded an honorary D. Litt. S. by Victoria University, Toronto in May 1965.

Since her retirement from teaching physiology in 1945, Enid T. Oppenheimer has been engaged in research in the cancer field at the Institute of Cancer Research of the College of Physicians and Surgeons, Columbia University. She is planning to attend the International Physiological Congress in Tokyo in September, leaving New York for that purpose on her 80th birthday.

T. E. Boyd recalls the Federation meeting of 1946 at Atlantic City. "There had been no meeting since 1942, and the place was swarming with youngsters. Ed Adolph, Phil Dow, Julius Comroe and I reported on "Physiology in North America, 1945. Time does bring changes."

Since retiring from Boston University three years ago Leland Wyman has devoted all his time to traveling and to research and writing in his second field, Navaho Indian ethnology. He has produced three books, one on Navaho Indian ethnoentomology, and two on Navaho Indian mythology and sandpaintings, and another is now in press. He hopes to continue this type of work (unpaid) and also to continue working in connection with the Museum of Northern Arizona, Flagstaff, Arizona, where he is Curator of Archives (part-time, and also unpaid). He and his wife like to travel and since retiring they have spent seven months in Egypt, Greece, Crete, Sicily, etc., and next October plan to start on an eight months trip to some eleven Asiatic countries, including Afghanistan, India, Nepal, Pakistan, Ceylon, Malaysia, Thailand, Cambodia, Hong Kong, Taiwan, and Japan. After forty years at Boston University, he wants to escape deadlines, fixed hours, and the like.

Peter Karpovich writes: "I am happy where I am. I don't care to go anywhere unless I go on my own. I don't want to have any office work, because I have enough now and probably for the next two or three years." He and his associates are getting very interesting results with electrogoniometers. They also have made the startling discovery that the efficiency of crawl swimming is greater when arms alone are used.

Janet Clark has an appointment as Lecturer at the School of Hygiene in Baltimore. This makes it possible for her to continue research and she is not interested in any other position.

Frederick R. Miller writes: "After 36 years of teaching and research in the physiological department of the University of Western Ontario I retired in 1950. My chief interest was electro-neurophysiology, a field which I regard as having great opportunities for important and fruitful discoveries. Professor Charles H. Best had courteously invited me to continue my research in his lab in the University of Toronto; also I studied very fully the field of electronics as applied to the central nervous system. I completed a lengthy paper based on work of Dr. Wai Wilkey a research student of mine. I am still immensely interested in this field of electrophysiology."

Ronald E. Scantlebury will continue in his present position until age 70. He plans to remain at the Department of State or return to NIH unless some unusual opportunity in the grants management or supervision of international students or research should arise.

Alexander Sandow continues at the Institute for Muscle Disease, as member, and Chief of the Division of Physiology.

S. Howard Bartley has just published a book on fatigue: "The Mechanism and Management of Fatigue," (Charles C Thomas, Publisher). It expresses the same outlook on the general subject of human inadequacy that his former book, "Fatigue and Impairment in Man" did in 1947. The present book is in the American Lectures in Living Chemistry, edited by Dr. I. N. Kugelmass. Its relevance in this series lies in the fact that it discusses the various current pharmaceuticals intended to relieve fatigue and depression, and the materials that have been advocated or found wanting in improving athletic performance. One of the essential features of the book is its distinction between impairment and fatigue, the former having to do solely with anomalous tissue function and its consequences, and the latter, the manifestations when the organism-as-a-person is involved. The distinction helps to clarify some of the complexities and indefiniteness found in treatments of the subject according to the more conventional viewpoint.

Esther M. Greisheimer is teaching the Inhalation Therapy Trainees, at Temple University Hospital, part-time. This teaching, together with the writing she has been requested to do keeps her fully occupied. She has given up her house and garden, and moved into an apartment: address - Apt. 709, School Lane House, Philadelphia, Pa. 19144.

H. B. Van Dyke reports from Malaya: "Through much of 1965 and probably in the first two months of 1966 I shall be working as Visiting Professor of Pharmacology in the Faculty of Medicine of the University of Malaya in Kuala Lumpur. This is a completely new school of medicine still under construction so far as the hospital and the facilities for clinical teaching and research are concerned. The facilities for the school will be among the finest in Asia. Classes corresponding to the first and second years of medicine in the United States are now being

taught. My task is to aid in the establishment of the new department of pharmacology for which the staff is being assembled."

Harold Ettinger after retiring from the Chair in physiology at Queen's University in 1962 (and, from the office of Dean of the Faculty of Medicine) stayed at the University for two years as a part-time "Advisor in Research", at the same time, spending three days a week in Toronto, with the Alcoholic and Drug Addiction Research Foundation. He is in full-time employment as Director of Medical Planning and is assured of continued employment as long as he wishes to work.

D. Bailey Calvin, formerly Professor of Biochemistry and Nutrition; Dean of students; and Director of Research Grants and Contracts, University of Texas-Medical Branch, Galveston, Texas, is now at the University of Miami School of Medicine, Miami, Florida as Assistant Dean for Research. This opportunity for continuity in the areas of research promotion and support began in June 1964 following thirty years of association with the University of Texas Medical Branch. He finds that this association with a young, growing institution, like the University of Miami School of Medicine, presents many challenging avenues of endeavor.

Ira A. Manville is engaged in nutritional research largely for the Northwest Apple and Pear industries. He is busy writing up the results of a two-year research on pears for the Oregon, Washington, California Pear Bureau. This has taken him into intermediate carbohydrate metabolism, the malabsorption syndrome and some abnormalities as cataract formation in disturbances in galactose utilization.

Carl G. Hartman is affiliated with the Margaret Sanger Research Bureau, 17 West 16th Street, New York, N.Y. 10010. He has completed a three-year study of semen quality or incidence of developmental anomalies and has two papers in press.

Alfred Redfield has published 13 scientific papers since 1956 all on the Physiology of the Environment. They include papers on tides, hydrography, the distribution of deuterium in natural waters, the recent changes in sea level, and the development of salt marshes. A number of them have attracted gratifying attention. He has been honored by the award of the Agassiz Medal (for oceanography) from the National Academy, an honorary Ph.D. from the University of Oslo, and D.Sc. from Lehigh University.

John Haldi expects to stay on in Atlanta. He retired the early part of 1964 and was appointed professor emeritus in September of that year with a year's contract for full time employment in research. The contract has been renewed for the coming academic year and there is the possibility of additional renewal.

Ralph Gerard is now Dean of the Graduate Division, Director of Special Studies and Professor of Biological Science at the exciting new University of California campus at Irvine, south of Santa Ana. His home overlooks the ocean and Balboa Bay.

J. Walter Wilson expects to remain at Brown University, Providence, R. I. He has excellent facilities and grant support adequate to continue his research. He is phasing out of administrative work and teaching; he expects to continue his cytology seminar and have an informal seminar on the history of biology.

Charles W. Gruber retired from Jefferson Medical College in 1953, went to Loma Linda University School of Medicine 1953 to 1957, retired again and became Visiting Professor in Biology, University of Redlands, 1957-1963, when he retired once more. However, he now gives some physiological demonstrations to the biological classes at U. of R. He has a granddaughter entering Indiana University School of Medicine this fall. She will be working for her A. M. degree in anthropology. Another granddaughter is on leave from Indiana studying Spanish at Lima, Peru.

After twelve years of emeritus status in the Department of Physiology, the University of Chicago, F. C. McLean is moving on October 1, 1965, to the College of Dentistry, University of Illinois, Chicago, with an appointment as Visiting Professor in the Department of Histology. His primary concern will be with the research program of the College of Dentistry. He will continue to have support from the National Institutes of Health for at least the academic year 1965-1966.

Ernst Gellhorn expects to complete in 1966, for the University of Minnesota Press, another book, "Autonomic-Somatic Integrations."

Dr. Philip B. Armstrong, Chairman of the Department of Anatomy, at the Upstate Medical Center, Syracuse, New York, has been re-elected Director of the Marine Biological Laboratory, to serve until August 1966.

J. Earl Thomas resigned as Chairman of the Department of Physiology at Loma Linda University to be succeeded by Dr. Clarence R. Collier as of July 1, 1964. He continues in the department with the title of Professor of Physiology; his research is supported by the PHS.

Israel S. Kleiner is Emeritus Professor of Biochemistry (in residence) at the New York Medical College, Flower and Fifth Avenue Hospitals. With L. B. Dotti, he is revising "Laboratory Instructions in Biochemistry" for a seventh edition, and with James M. Orten, is revising their textbook "Biochemistry" also for a seventh edition. Both are published by the C. V. Mosby Co., St. Louis, Mo.

Evelyn Anderson expects to continue independent research, with the Space Administration, until 70 years old. She may then start a new career in the practice of geriatrics.

H. S. Mayerson is Associate Director in charge of Medical Services and Education, the Touro Infirmary of New Orleans. His job is to rejuvenate the training program as well as to improve the usual laboratory services, pathology and radiology. He keeps an affiliation with the Department at the Medical School, directing at least one graduate student, and will lecture to the freshmen when the course rolls around.

Waid Tuttle works three months for the University and the rest of his free time as a consultant for the Cereal Institute Inc. in Chicago.

F. T. Jung in 1956 became an assistant editor of the Journal of the American Medical Association, and in 1960 a department editor in charge of abstracts and translations, working with a fine crew of linguists, supervising a weekly column of abstracts in Interlingua, and writing editorials and book reviews. He retired in 1963; since then he has become involved in consulting, writing, and translation projects.

Stanley P. Reimann, Director emeritus of the Institute for Cancer Research, has, with Dr. Grace Medes, published a book entitled, "Normal Growth and Cancer," J. B. Lippincott Co. Now he is engaged in compiling a History of the Lankenau Hospital Research Institute and the Institute for Cancer Research, which began in one small room in the old Lankenau Hospital in 1922 and now, under the single name of the Institute for Cancer Research has blossomed forth into a large institute with over 175 research workers. This is now under the very able directorship of Timothy R. Talbot, 7701 Burholme Avenue, Fox Chase, Philadelphia, Pa. 19111.

A. H. Hegenauer, after retiring in 1964, became Scientific Advisor for Environmental Medicine, U.S. Army, Research Institute for Environmental Medicine, Natick, Mass. He is occupied with research planning in the biomedical sciences.

Carl A. Dragstedt has a summer cottage in the colony on Elk Lake, Michigan, established by A. J. Carlson, Arno Luckhardt, Fred Koch and other Chicago-land physiologists. He reports that Dwight Ingle has recently joined this group, and is now making the ghosts of these great men gape by his capers on a surf board, using an umbrella as the energy source, in the manner of Mary Poppins.

Louis Katz wonders whether our Committee might pursue the idea expressed by Hermann Rahn in his Past-President's address, published in *The Physiologist*, namely, to establish a corps of Senior Physiologists whose task it would be to summarize the mass of literature, which is overwhelming because of its quantity, in the areas of their special competence. In this way authoritative reviews could be constantly published that would separate the wheat from the chaff, and so help physiologists, who are not experts in the particular areas covered, to keep abreast with the expanding knowledge. There is no reason why such reviews should avoid antagonistic attitudes. He believes that such a program could usefully employ a great number of retired scientists whose talents otherwise might go to waste. This will be considered by the Committee on Senior Physiologists and will be brought to the attention of the Committee on Emeriti, AIBS. When Louis retires in 1970 he will do some writing, will advise on research projects and act, in general, as a consultant in the areas of his competence.

Otis O. Benson, Jr. since his retirement has become Staff Director, Biosciences and Bioengineering, of the Southwest Research Institute, San Antonio, Texas. Following a distinguished career, General Benson

received the John Jeffries Award of the Institute of the Aeronautical Sciences in 1951; the Lyster Award - Aeromedical Association, 1955; and the Hubertus Strughold Award in Space Medicine, 1964.

Frank A. Hartman is collaborating on several research projects and writing a new book on the adrenal.

Wilhelm Raab is editing a book on "Preventive Cardiology" with 58 articles from experts in 12 countries: biochemists, physiologists, clinical cardiologists, pharmacologists, pathologists, psychologists, sociologists, epidemiologists, medical and physical educators. He believes that each of these disciplines has much to offer to the total spectrum of multifaceted Preventive Cardiology without even realizing it.

Chalmers Gemmill has been in England on a Commonwealth Fellowship working on the problem of Silphium at the Wellcome Historical Medical Library. Silphium was a plant growth around Cyrene in North Africa and exported between 600 B. C. - 100 A. D. to all parts of the Greek and Roman world. It was used for many diseases. His grant included a trip to Cyrene which is 120 miles east of Benghazi. He is coming home by way of Tokyo, attending the International Congress.

Sam Pond reports that he has had a hand in obtaining for "Rehabilitation Medicine" in Connecticut large increases in personnel and intensive programs with longer, future plans in psychiatry, psychiatry and neurology. Present research consultants are concentrating on improved recording and measurement schemes for vocational counseling and guidance, cooperative coding and recording with medical and training professions (intensifying therapy and re-education for partially disabled under new social security programs) as well as meeting current needs of citizens with physical and mental handicaps, and utilizing mechanical aids for reporting by electronic computers in new state data tabulating centers.

This coming year Dickinson W. Richards hopes to work with Andre Cournand bringing together some material that they never have had time to publish.

Herrman L. Blumgart, retired in 1962, is on the editorial board of the New England Journal of Medicine. He is Consultant in medicine to the Peter Bent Brigham Hospital and to the Harvard Health Service branch at the Harvard Medical School.

Frieda Robscheit Robbins Sprague continues travelling; she is looking forward to visiting southern Europe next summer.

After 45 years on the faculty of George Williams College, Arthur H. Steinhaus retires this fall as Dean Emeritus and Professor of Physiology. He has accepted an appointment as Distinguished Service Professor of Physiology with the Chicago College of Osteopathy. This is an approximately two-thirds time assignment that will permit attention to other activities such as a three-week trip to South Africa as the American Guest of Honor to the 50th Anniversary Celebration of the Founding of

the South African Association of Physical Education and Recreation. He will extend his research in the teaching of neuromuscular relaxation to pregnant women and high school students in the coming year.

Arthur S. Gilson has made arrangements to continue with research at Washington University for the coming year.

Robert A. Kehoe retired on June 30 as Director of the Department of Preventive Medicine and Industrial Health (including the Kettering Laboratory), in the College of Medicine, University of Cincinnati, and has been succeeded by Edward P. Radford, Jr. After completing a brief engagement as special consultant to the Pan-American Health Organization in Santiago, Chile, he expects to return to Cincinnati and to keep free of other professional tasks and assignments, so as to devote his time, for some years to come, to the assembling and study of data accumulated during the years when he was too heavily involved in administrative and professionally "evangelical" duties to attend properly to his scientific job.

Willamina and Harold E. Himwich spent about three weeks in Japan, arriving there April 19 and leaving on May 9. Harold was guest speaker at the Annual Meetings of the Japanese Society of Psychiatry and Neurology. Their trip gave them an opportunity to learn something about the people in Japan, their customs and viewpoints as well as a better understanding of the status of the Japanese medical sciences. Both spoke at Osaka, and both presented papers for the Department of Pharmacology at the National University of Kyoto and Department of Psychiatry of the National University in Tokyo. They report much scientific ferment and observed many important contributions in the field of psychopharmacology, the organic aspects of psychiatry and in neurophysiology. The Shionogi Pharmaceutical Laboratories at Osaka compare with the best we have. They took many side trips to cities with historic sites and beautiful temples and shrines. Japanese hospitality is proverbial; everywhere they were met with the greatest expressions of friendliness.

Irvine H. Page retires next year but has no intention of going fishing. He will continue as editor of "Modern Medicine" and will continue to keep up direct contacts with medicine and science as well as some work in the laboratory.

After Robert W. Clarke retired in 1961, his only contact with physiology has been The Physiologist, which he reads from cover to cover.

Eleanor Mason's address is: The Farncombe Community, 5 Wolseley Road, Farncombe, Godalming, Surrey, England. She reports on her project: "Our little ecumenical Community for Prayer for Unity has been drawing friends, old and new, from many countries and from a wide range of churches, who come to see us and share the life here. We seem to be a living part of the world-wide movement toward unity, and are kept busy, physically and in every way, maintaining our house and rhythm of life for ourselves and our guests." Two papers have appeared recently reporting her last work in India, one on racial group differences and one on age differences in basal metabolism and body composition of women

in Bombay. A third paper, reporting studies on effects of change of climate on persons, both men and women, moving between tropical Bombay and temperate climates, has yet to be written.

Edward Larson has been requested to teach for another year although past the university's retirement age. He has published two papers recently on toxic fish and has the laboratory data completed for another paper on the toxicity of the Horse-Eyed Jack. He remembers with kindly feelings his summer at the Army Chemical Center Laboratories with Henry Wills and Bruce Dill.

Edward G. Boyden is still a research professor with the University of Washington, and has just returned from Europe where he lectured in Greece and at the American University in Beirut, and then attended the International Congress of Anatomists in Wiesbaden. He does some teaching, and is continuing works on the biliary tract and postnatal growth of the human lung. He has just found that the whale has no sphincter of Oddi - so that the rule still holds, "no gall bladder, no sphincter."

Max Kleiber reports that he is growing older: he no longer can keep pace with his son in skiing. He remarks that "aging of the brain makes it more difficult to keep abreast of new achievements in science but still the "old gray mare" is not useless. It means, however, selection of activities for which we are still fit. In my case, writing and lecturing on topics which are familiar to me such as the, by now classical, aspects of energy metabolism. I just finished the translation of my book "The Fire of Life, an Introduction to Animal Energetics" into German whereby I was author, translator and typist in one person. I enjoyed that work, I also enjoyed lecture tours to Pullman, Washington, to East Lansing, Michigan, Ohio, Purdue, Illinois and recently to Alabama and Florida; also a few lectures at Hawaii. Off and on I have had an opportunity to talk on topics beyond my professional field of metabolism and nutrition, such as "Scientists are human" (Davis), "The Conscience of an agonistic" (Hawaii Unitarian Church), "Freedom and population" (Davis and Michigan). Stimulating and enjoyable was a debate with Edward Teller (Davis, 1962) in the question "Should the U. S. resume atmospheric nuclear testing?" My retirement gives me a chance to read more in the general field of human relations and history and this I hope will make me fit to function occasionally as a sort of wandering preacher of science and humanism. Professionally I plan to start this fall writing a small book on feed evaluation."

Hiram Essex completed four years as President of the National Society for Medical Research the first of July and was happy to turn over the gavel to Maurice Visscher. He is now completely occupied with two farms, cattle breeding, painting and other activities.

Richard Whitehead retired as Chairman and Professor of Pharmacology, University of Colorado School of Medicine in June 1964. He spent the year 1964-65 as a Fulbright Fellow at the Department of Pharmacology at Trinity College, Dublin, Ireland, enjoying thoroughly Ireland's unrivaled scenery, fascinating history and hospitable people. Since July 1965, he is serving as Assistant to the Dean for Alumni Affairs

at the University of Colorado Medical School.

Lucien Brouha has been Medical Research Director, Human Resources Center, Albertson, New York, from December 1, 1964 until September 30, 1965. He leaves then to become Director of the Fitness Research Unit, School of Hygiene, University of Montreal.

Harold Holck has collaborated with Miya of Purdue in revising their Laboratory Guide in Pharmacology; is serving as President of the University of Nebraska Emeriti Association for a third year term; and is co-chairman of the Section on History and Philosophy of Science of the Nebraska Academy of Sciences.

H. Necheles writes as follows: "My career really began when I went to my professor in Hamburg as a fifth year medical student and told him that I had a good idea how to construct an artificial kidney, not knowing that John Abel had constructed one at Hopkins. I was successful and my kidney was the first one used in man in Germany in about 1922 or 1923. I used this as my M.D. thesis. I also obtained my Ph.D. in natural sciences at the University of Hamburg, where I worked quite successfully on the thermoregulation of insects, in which I was able to demonstrate that insects are able to regulate their body temperatures considerably by evaporation or retention of water. I had wonderful years in China as well as in Chicago, and I have no regrets for having chosen the career of an investigator over that of a practicing physician."



NAPLES ZOOLOGICAL STATION

The American Tables Committee is now reviewing applications for laboratory space at the Naples Zoological Station, Naples, Italy. This Station, offering opportunities in behavioral, physiological, biochemical, and radiological research, is supported in large measure by various institutions throughout the world. The United States has supported the Station in recent years by buying ten of these "tables"; each table providing all of the logistic support for the researcher during the year. The Tables Committee of the American Institutes of Biological Sciences, sponsored by a grant from the National Science Foundation, accepts and reviews applications and makes selections of scientists.

Applications must be submitted at least six weeks prior to the date for beginning research. Requests for forms should be made directly to Richard J. Burk, American Institute of Biological Sciences, 3900 Wisconsin Avenue, N.W., Washington, D.C. 20016.

ON THE CRANIAL NERVES

JAMES R. KING*

II

Deployed toward the optic cortex
Impinging spikes ascend in vortex
Through subtle, sifting nuclei.
Through the gray reticulum
Toward layered neopallium
The silent signals haunt and sigh;
Past memoried snares of old events
And patterned plans of new intents
Emerging visions multiply.

V and VII

Facial and trigeminal convey
From lips and tongue the sense away
Of gentle tactile perturbations.
Projected on the learned gyrus,
Galvanic ghosts awake and fire us
With images of osculation.

"For several years I have been plodding toward completion of a set of twelve verses concerning the functions of the cranial nerves. Here are a couple of examples, with the thought that other members of the Society might wish to join this effort." - J. R. King, Washington State University, Pullman, Wash.



TRANSLATION OF EXPERIMENTS IN BINAURAL HEARING IN NOISE

Copies of "Experiments in Binaural Hearing in Noise" by Harald Feldmann are now available in an English translation.

This article by Dr. Feldmann represents an important contribution toward our understanding of how signals received simultaneously by both ears in a binaural hearing situation might be processed centrally.

The Feldmann translation is the 18th in a series. This and earlier works in audiometry by various authors may be obtained by writing to the Beltone Institute for Hearing Research, 4201 W. Victoria St., Chicago, Ill. 60646.

SECOND INTERNATIONAL BIOPHYSICS CONGRESS
Vienna (Austria) September 5-9, 1966

General sessions of invited papers will be devoted to energy transfer and conversion, to molecular aspects of differentiation, and to emerging developments in biophysics. There will also be symposia arranged by the Commissions on:

Molecular Biophysics
Cell and Membrane Biophysics
Communication and Control Processes
Radiation Biophysics

by the Committee on Education, and by affiliated commissions of IOPAB.

Contributed papers on all subjects of biophysics will be accepted. Abstracts of such papers will be due by May 15, 1966.

Inquiries should be directed as follows:

Scientific Program:

Secretariat: Wien, IX, Alserstrasse 4, Telephone: 42-61-87
Wiener Medizinische Akademie, Mrs. E. Weidenhaus

Housing, travel arrangements and entertainment program:

Reisedienst der Wiener Medizinischen Akademie,
Wien, IX.
Alserstrass 4, Telephone: 63-45-13

The National Academy of Sciences which adheres to IOPAB on behalf of the United States will seek funds from Federal agencies for partial travel expenses of U.S. participants in the Congress. Persons wishing to apply for a travel grant should write to Miss Inger Hermann, National Academy of Sciences-National Research Council, 2101 Constitution Avenue, Washington, D.C. 20418.

INDEX

November 1957 - November 1965

Abstracts of Papers Presented at Fall Meetings

1957 - Sept. 3-6, State Univ. of Iowa, Iowa City, Iowa - Vol. 1, #1, 1-92
1958 - Sept. 2-5, Univ. of Western Ontario, London, Ont. Canada - Vol. 1, #4, 1-88
1959 - Sept. 8-11, Univ. of Illinois, Urbana, Ill. - Vol. 2, #3, 1-126
1960 - Aug. 23-26, Stanford Univ., Stanford, Calif. - Vol. 3, #3, 4-184
1961 - Sept. 5-8, Indiana Univ., Bloomington, Ind. - Vol. 4, #3, 1-137
1962 - Aug. 28-31, Univ. of Buffalo, Buffalo, N. Y. - Vol. 5, #3, 97-235
1963 - Aug. 27-30, Univ. of Miami, Coral Gables, Fla. - Vol. 6, #3, 125-303
1964 - Sept. 7-11, Brown Univ., Providence, R. I. - Vol. 7, #3, 77-293
1965 - Aug. 24-28, Univ. of California at Los Angeles, Vol. 8, #3, 97-312
ACTH, Hypothalamic Control of - Vol. 4, #1, 56-61
Adolph, E. F. - Vol. 1, #2, 39-46; Vol. 1, #3, 29-35; Vol. 7, #1, 7-8
Adrenal-Pituitary Axis and Aging in Cattle - Vol. 8, #4, 336
Aldosterone Secretion, Control of - Vol. 5, #2, 65-86
Alfonso, S. - Vol. 3, #4, 56-62
AAAS - Vol. 1, #3, 35; Vol. 1, #5, 43-44; Vol. 4, #4, 61; Vol. 5, #4, 256; Vol. 7, #4, 333
AIBS - Vol. 2, #4, 25-27; Vol. 4, #1, 22; Vol. 4, #4, 57-60; Vol. 7, #2, 70; Vol. 7, #4, 343-346

American Physiological Society

APS and Affiliations - Vol. 1, #3, 4-7
APS and Youth - Vol. 7, #1, 3-5
Broader Scope of APS - Vol. 5, #1, 3-4
Future Meetings - Vol. 6, #4, 318; Vol. 7, #4, 304; Vol. 8, #2, 56
History of APS - Vol. 5, #4, 269
Reorganization of Activities - Vol. 4, #4, 29-33
75th Anniversary - Vol. 6, #2, 83
Society Elections - Vol. 2, #1, 2-3; Vol. 2, #4, 2
Animal Behavior Society - Vol. 8, #4, 340
Animal Care - Vol. 2, #4, 47; Vol. 3, #1, 49; Vol. 5, #2, 58-60; Vol. 5, #4, 307; Vol. 6, #1, 53-62; Vol. 6, #4, 330-331; Vol. 7, #1, 30-32
Apparatus for Teaching Lab. - Vol. 3, #4, 50-51
Anniversary, 75th of APS - Vol. 6, #2, 83; Vol. 6, #4, 316
Arendt, K. A. - Vol. 8, #1, 46-47
Arterial Receptors of Aves - Vol. 8, #4, 337-338
Asratian, E. A. - Vol. 3, #2, 48-50
Assali, N. S. - Vol. 8, #4, 339-340
Associate Membership - Vol. 1, #2, 21-22; Vol. 1, #3, 3
Attendance at Fall Meetings - Vol. 1, #2, 3
Attendance at Spring Meetings - Vol. 4, #1, 21; Vol. 4, #2, 9; Vol. 5, #2, 46; Vol. 6, #2, 74; Vol. 7, #2, 47; Vol. 8, #2, 49
Aviado, D. M. - Vol. 8, #1, 48
Bach, L. M. N. - Vol. 7, #2, 60-68
Bard, P. - Vol. 5, #1, 8-9; Vol. 6, #4, 324-327

Barker, S. B. - Vol. 6, #2, 94-114
Bauereisen, E. - Vol. 5, #4, 293-299
Beck, R. - Vol. 8, #4, 339-340
Behavioral Aspects of Neurophysiology - Vol. 5, #4, 270-284
Behavioral Experiments with Pigeons and Goats - Vol. 8, #4, 335-336
Beidler, L. M. Vol. 3, #1, 5-12
Bernard, Claude and the Cell - Vol. 4, #4, 62-68
Biological Instrumentation - Vol. 7, #2, 60-68
Booth, N. H. - Vol. 8, #4, 338-339
Bowditch Lectures

First - Role of RBC in Regulation of Renal Blood Flow and Glomerular Filtration Rate - J. R. Pappenheimer - Vol. 1, #3, 8-24
Second - Physiological Adaptation to Environment - B. Schmidt-Nielsen - Vol. 1, #2, 4-20
Third - Cardiopulmonary Physiology and the Body Plethysmograph - A. B. DuBois - Vol. 2, #1, 8-23
Fourth - Physiology of Taste - L. M. Beidler - Vol. 3, #1, 5-12
Fifth - Micropuncture Studies of Tubular Function - C. W. Gottschalk - Vol. 4, #1, 35-55
Sixth - Surface Phenomena in Relation to Pulmonary Function - J. A. Clements - Vol. 5, #1, 11-28
Seventh - Intestinal Absorption of Vitamin B₁₂ - T. H. Wilson - Vol. 6, #1, 11-26
Eighth - Transport of Large Molecules Across Capillary Walls - E. M. Renkin - Vol. 7, #1, 13-28
Ninth - Atmosphere and Oxygen - D. L. Gilbert - Vol. 8, #1, 9-34

Bowditch, M. - H. P. Bowditch, Memoirs - Vol. 1, #5, 7-11
Brookhart, J. M. - Vol. 2, #4, 48-49; Vol. 5, #2, 61-64
Brown, J. H. U. - Vol. 5, #4, 248-255
Burton, A. C. - Vol. 6, #4, 319-323

Cannon, W. B. - Vol. 1, #5, 37-42; Vol. 6, #1, 4-5
Cardiac Excitability - Vol. 3, #4, 70-77
Cardiovascular Physiology, Current Trends in - Vol. 6, #2, 115-120
Career Brochure - Vol. 7, #2, 57-58
Carlson, A. J. - Vol. 2, #2, 33-39
Carlson, L. D. - Vol. 6, #1, 29-39
Cell Membranes, Movement of Materials across - Vol. 3, #4, 56-62
Chittenden, R. H. - Vol. 3, #1, 3-4
Clements, J. A. - Vol. 5, #1, 11-28
Code, C. F. - Vol. 2, #1, 38-41
Cohen, B. J. - Vol. 7, #1, 30-32
Comparative Physiology of Urinary Secretion - Vol. 5, #4, 257-263
Comroe, J. H., Jr. - Vol. 1, #5, 27-30; Vol. 3, #2, 45-47; Vol. 3, #4, 10-13; Vol. 4, #2, 18-21
Congresses, International
XXI, Buenos Aires - Vol. 1, #3, 25-26; Vol. 2, #4, 15-16
XXII, Leiden - Vol. 4, #4, 24-26; Vol. 6, #1, 51-52
XXIII, Tokyo - Vol. 7, #1, 32; Vol. 7, #2, 59; Vol. 7, #4, 318; Vol. 8, #1, 39
Coronary's Code - Vol. 8, #1, 34
Councilors' Tours - Vol. 3, #1, 17-19; Vol. 5, #2, 61-64; Vol. 6, #2, 89-93;

Vol. 7, #4, 347-349; Vol. 8, #2, 62-63
Course for Physicians - Vol. 3, #1, 2; Vol. 5, #1, 42; Vol. 7, #1, 12
Cranial Nerves, on the - Vol. 8, #4, 365

Davenport, H. W. - Vol. 3, #1, 17-19; Vol. 4, #2, 22; Vol. 4, #4, 27-28;
Vol. 5, #1, 29-31; Vol. 5, #4, 265-269

Davis, H. - Vol. 1, #3, 43-48; Vol. 1, #5, 49-55; Vol. 2, #2, 7; Vol. 2, #4,
17-24; Vol. 7, #1, 9-11

Davis, J. O. - Vol. 5, #2, 65-86

Dawson, Percy - Vol. 7, #1, 42-44

Desert Reunion - Vol. 8, #1, 43-45

Dill, D. B. - Vol. 1, #2, 28-30; Vol. 2, #2, 64-66; Vol. 5, #2, 87-89; Vol. 6,
#1, 40-43; Vol. 7, #1, 36-37; Vol. 8, #1, 43-45

Doctorates, distribution of - Vol. 6, #2, 80-81

Doty, R. W. - Vol. 5, #4, 270-284

Dowler, Bennet - Vol. 3, #1, 39-46

DuBois, A. B. - Vol. 2, #1, 8-23; Vol. 3, #4, 50-51

DuBois, E. F. - Vol. 2, #2, 64-66

Dues, Assessment for 1968 Congress - Vol. 8, #2, 49; 56

Dues, Change in Method of Payment - Vol. 5, #1, 4

Dynamics of the Fetal Lamb Circulation Before and After Birth -
Vol. 8, #4, 339-340

Education

Apparatus for Teaching Lab. - Vol. 3, #4, 50-51

Balance Between Depth and Broad Coverage in Graduate Training in
Physiology - Vol. 8, #2, 68-72

Biological Instrumentation - Vol. 7, #2, 60-68

Biology, Study and Teaching of - Vol. 3, #2, 8-14

Career Brochure - Vol. 7, #2, 57-58

Course for Physicians - Vol. 3, #1, 2; Vol. 5, #1, 42; Vol. 7, #1, 12

Curriculum, a 4-year in Physiology - Vol. 4, #4, 51-56

Demonstration as Adjunct to Teaching - Vol. 3, #2, 51-58

Dental Students, Teaching of - Vol. 2, #1, 42-68

Education Committee Activities - Vol. 1, #2, 39-46; Vol. 2, #1, 28-33;
Vol. 4, #4, 34-37

Graduate; Statistics on Students - Vol. 1, #2, 27

Graduate Training for Ph. D. - Vol. 4, #4, 3; Vol. 6, #1, 7-10; Vol. 8, #1,
40-42

Graduate Training in Physiology - Vol. 5, #4, 248-255; Vol. 8, #2, 67

If I Had To Do It All Over Again - Vol. 8, #2, 86-91

Integrated Teaching - Vol. 1, #2, 38

Laboratory Experiments - Vol. 2, #4, 33-39; Vol. 4, #4, 69-71; Vol. 8,
#2, 59

Medical School Requirements - Vol. 1, #5, 27-30

Monographs in Physiology - Vol. 2, #2, 67-72

Movie Aids in Teaching Gastrointestinal Physiology - Vol. 2, #1, 38-41

Refresher Course - Vol. 8, #2, 58-59; Vol. 8, #4, 332-340

Research Obstacles in Colleges - Vol. 1, #3, 40-42

Research Training and the NIH - Vol. 3, #1, 32-38

Science Education - Vol. 2, #2, 55-57

Some Criteria for Evaluation of the Development and Performance

for Graduate Students in Physiology - Vol. 8, #2, 73-76
Summer Training for College Teachers - Vol. 1, #5, 26-27; Vol. 2, #4, 32-33; Vol. 4, #2, 16-17
Teachers Needed - Vol. 7, #4, i
Teacher Recognition - Vol. 4, #2, 4-5
Teaching Medical Students During First Half 20th Century - Vol. 7, #1, 33-34
Teaching of Physiology in State Universities - Vol. 1, #3, 29-35
The Facts of Life - Vol. 8, #2, 64-66
The Teacher and Ferment in Education - Vol. 3, #4, 20-29
The Terminal Master's Degree in Physiology - Vol. 8, #2, 77-85
Use of Avian and Large Domestic Animals in Physiological Research - Vol. 8, #4, 332-340
Veterinary Medical Schools - Vol. 6, #2, 89-93
Visiting Scientist Program - Vol. 4, #4, 38-43
Workshops for College Teachers - Vol. 1, #5, 45-48; Vol. 3, #1, 27-31
Eggleston, J. F. - Vol. 6, #4, 358-359
Einthoven Lecture - Vol. 6, #1, 50
Electrical & Mechanical Events in Frog Heart - Vol. 2, #4, 40-46
Enemies of Physiology - Vol. 6, #4, 330-331
Essex, H. E. - Vol. 6, #4, 330-331
Evolution, Physiology and Finality - Vol. 2, #2, 50-54
Experimental Anesthesia - Electrical Anesthesia on Cattle and Sheep - Vol. 8, #4, 332-333

Farner, D. S. - Vol. 8, #2, 73-76
Fashions in American Physiology - Vol. 6, #4, 319-323
Federation - Vol. 4, #1, 12-20; Vol. 8, #1, 3-5
Fenn, W. O. - Vol. 2, #4, 25-27; Vol. 3, #1, 20-26; Vol. 4, #4, 57-60; Vol. 6, #1, 44-46; Vol. 6, #1, 47-48; Vol. 8, #1, 2
Finances, APS - Vol. 2, #2, 4; Vol. 3, #4, 33-39; Vol. 5, #2, 52-53; Vol. 6, #2, 78-79; Vol. 7, #2, 51-52; Vol. 8, #2, 54-55
Fisher, J. - Vol. 8, #4, 348-352
Flamingos, On Feeding of - Vol. 3, #4, 52-55
Florey, E. - Vol. 5, #4, 285-292
Forbes, A. - Vol. 3, #2, 31-44
Forster, R. E. - Vol. 7, #4, 347-349
Fox, D. L. - Vol. 3, #4, 52-55
Freeman, D. K., Jr. - Vol. 3, #4, 49
Future of Physiology, Some Aspects of - Vol. 7, #4, 347-349

Gale, C. C. - Vol. 8, #4, 333-334
Gastric Secretion, Control of - Vol. 6, #4, 349-357
Gavel, APS - Vol. 1, #5, 34-36; Vol. 2, #2, 7
Gerard, R. W. - Vol. 3, #4, 46-49; Vol. 6, #1, 49; Vol. 6, #4, 332-334
Gilbert, D. L. - Vol. 8, #1, 9-34
Gottschalk, C. W. - Vol. 4, #1, 35-55
Greep, R. O. - Vol. 2, #1, 42-68
Grodins, F. S. - Vol. 7, #4, 319
Gross, P. R. - Vol. 2, #4, 40-46
Grossman, M. I. - Vol. 6, #4, 349-357
Grover, E. B. - Vol. 8, #4, 337
Grover, R. F. - Vol. 8, #4, 337

Growth of APS - Vol. 4, #2, 14

Guidelines for the Committee on Membership - Vol. 8, #1, 35-39

Hamilton, W. F. - Vol. 7, #1, 38-41; Vol. 8, #2, 95-96

Hardy, J. D. - Vol. 4, #4, 16-19; Vol. 8, #2, 62-63

Henderson, L. J. - Vol. 1, #2, 32-37

Henshaw, R. E. - Vol. 8, #4, 348-352

Herrick, J. F. - Vol. 3, #4, 63-69

High Altitude, Reunion at - Vol. 6, #1, 40-43

High Altitude Studies in Cattle and Sheep - Vol. 8, #4, 337

Himwich, W. - Vol. 2, #2, 12-17; Vol. 3, #1, 47-48; Vol. 4, #4, 72-79

History, APS and Physiology - Vol. 4, #2, 34-39; Vol. 4, #4, 44-50;

Vol. 5, #1, 35-40; Vol. 5, #2, 90-96; Vol. 5, #4, 300-307; Vol. 5, #4, 269

Hitchcock, F. A. - Vol. 1, #5, 43-44

Hoffman, B. F. - Vol. 3, #4, 70-77

Hogben, C. A. M. - Vol. 3, #4, 56-62

Hopwood, M. L. - Vol. 8, #4, 338-339

Howell, W. H. - Vol. 4, #1, 5-11

Human Voices - Vol. 5, #4, 265-269

Hypothalamus in the Regulation of Energy and Water Balance - Vol. 7,
#4, 305-318

Hypothermous Operations of Warm Blooded Animals - Vol. 2, #2, 18-32

Income of Physiologists in Medical Schools - Vol. 4, #2, 18-21

Indicator-Dilution Technics - Vol. 4, #1, 62-81

Information, Retrieval and Evaluation of - Vol. 7, #1, 29

International Biological Programme - Vol. 7, #2, 71-73

International Physiology - Vol. 1, #3, 25-26; Vol. 4, #4, 24-26; Vol. 6, #1,
44-46; Vol. 6, #1, 51-52; Vol. 6, #4, 332-334; Vol. 6, #4, 335-337;
Vol. 7, #1, 32; Vol. 7, #2, 71-73; Vol. 7, #2, 74-75; Vol. 7, #4, 318;
Vol. 8, #1, 39

Irving, L. - Vol. 2, #2, 18-32

Ivy, A. C. - Vol. 2, #2, 33-39; Vol. 7, #1, 33-34

Izquierdo, J. J. - Vol. 8, #4, 325-327

Katz, L. N. - Vol. 1, #2, 50-51; Vol. 1, #5, 18-25; Vol. 6, #1, 50; Vol. 6,
#4, 328-329

King, J. R. - Vol. 8, #4, 365

Kirschbaum, T. - Vol. 8, #4, 339-340

Landis, E. M. - Vol. 7, #1, 3-5

Lane-Petter, W. - Vol. 6, #2, 121-124

Langley, L. L. - Vol. 3, #2, 51-58

Lee, F. S. - Vol. 7, #1, 1-2

Lee, M. O. - Vol. 3, #2, 23-29

Leiden - Vol. 4, #4, 24-26; Vol. 6, #1, 47-48; 49; 50; 51-52

Lombard, W. P. - Vol. 8, #1, 1-2

London, Society for Visiting Scientists - Vol. 4, #1, 34

Lucas, W. - Vol. 8, #4, 339-340

Ludwig, Carl - Vol. 5, #4, 293-299

Machine Programming of Sessions - Vol. 3, #4, 30-32

Mann, F. C. - Vol. 6, #1, 66-69

Manpower Study - Vol. 6, #2, 80-81
Marshall, L. H. - Vol. 7, #2, 57-58; Vol. 8, #2, 64-66
Martin, A. W. - Vol. 1, #3, 40-42
Martin, H. N. - Vol. 2, #2, 8-11; Vol. 3, #2, 8-14
Mayerson, H. S. - Vol. 3, #1, 39-46; Vol. 4, #4, 38-43; Vol. 6, #1, 27-28;
Vol. 6, #4, 338-348
McGinnis, C. H. - Vol. 8, #4, 337-338
Medicine & Allied Health Professions - Vol. 3, #4, 40-45
Meltzer, S. J. - Vol. 5, #1, 5-7
Membership - Vol. 2, #4, 11; Vol. 4, #4, 16-19; Vol. 5, #2, 51; Vol. 8, #1,
35-39; Vol. 8, #2, 60-61
Membership Status - Vol. 1, #5, 12-13; Vol. 2, #4, 11-15; Vol. 3, #4, 14-18;
Vol. 4, #4, 12-15; Vol. 5, #4, 244-247; Vol. 6, #4, 312-315; Vol. 7, #4,
301-304; Vol. 8, #2, 50-53; Vol. 8, #4, 328-331
Mitchell, S. W. - Vol. 2, #1, 4-7
Monographs - Vol. 2, #2, 67-72
Musacchia, X. J. - Vol. 8, #2, 77-85
Muscle Lever (Isotonic) for Electronic Recording - Vol. 8, #4, 348-352

Naples Zoological Station - Vol. 8, #4, 364
National Research Council - Vol. 3, #4, 46-49; Vol. 6, #2, 84; 85-87
National Society Medical Research - Vol. 7, #1, 30-32
Nellor, J. E. - Vol. 8, #4, 336
Neurohormones - Vol. 5, #4, 285-292
Neurophysiology, Growth of - Vol. 3, #2, 31-44

Papers for Spring Meeting

Rules for presenting - Vol. 5, #4, 255; Vol. 6, #4, 318
Titles of Papers - Vol. 4, #2, 40-42
Pappenheimer, J. R. - Vol. 1, #3, 8-24; Vol. 6, #2, 89-93; Vol. 7, #4, 343-
346; Vol. 8, #4, 341-347
Past-Presidents' Addresses
A Bicycle in the Age of Jets - Pappenheimer - Vol. 8, #4, 341-347
APS and Youth - Landis - Vol. 7, #1, 3-5
Enemies of Physiology - Essex - Vol. 6, #4, 330-331
Fashions in American Physiology - Burton - Vol. 6, #4, 319-323
Human Voices - Davenport - Vol. 5, #4, 265-269
International Physiology - Gerard - Vol. 6, #4, 332-334
Limbic Elements in Publication Policies - Visscher - Vol. 6, #4, 324-327
Organization of Scientific Communication - Davis - Vol. 7, #1, 9-11
Personal Recollections - Hamilton - Vol. 7, #1, 38-48
Physiologists and the Information Crisis - Rahn - Vol. 7, #4, 334-342
Physiologists in World War II - Dill - Vol. 7, #1, 35-37
Physiology and Physiologists - Katz - Vol. 1, #3, 18-25
Physiology and Physiologists in the Gay Nineties - Mayerson - Vol. 6,
#4, 338-348
Relation of the Physiologist to the Public - Katz - Vol. 6, #4, 328-329
Retrieval and Evaluation of Information - Visscher - Vol. 7, #1, 29
Tasks of Physiologists - Adolph - Vol. 7, #1, 7-8
Teaching of Physiology to Medical Students - Ivy - Vol. 7, #1, 33-34
The Teacher and the Ferment in Education - Pitts - Vol. 3, #4, 20-29
There are so Darn Many of Us - Davis - Vol. 2, #4, 17-24

Past-Presidents' Pictures - Vol. 2, #4, 29-31; Vol. 6, #4, 317

Peterson, L. H. - Vol. 6, #2, 115-120

Physiologists

Distribution of Doctorates - Vol. 6, #2, 80-81

In World War II - Vol. 7, #1, 35-37

Mobility of - Vol. 4, #4, 20-23

Relation to the Public - Vol. 6, #4, 328-329

Physiology and Physiologists - Vol. 1, #5, 18-25

Physiology and Physiologists in Gay Nineties - Vol. 6, #4, 338-348

Salaries - Vol. 1, #5, 14

Status of - Vol. 1, #3, 37-40

Supply and Demand of - Vol. 3, #4, 19

Tasks of - Vol. 7, #1, 7-8

There are so Darn Many of Us - Vol. 2, #4, 17-24

Physiology in Orbit - Vol. 3, #1, 20-26

Pitts, R. F. - Vol. 2, #2, 61-63; Vol. 2, #4, 55-59; Vol. 3, #4, 20-29; Vol. 3, #4, 40-45

Popovic, V. - Vol. 8, #3, 313-320

Porter Fellowship - Vol. 1, #5, 15-17; Vol. 2, #4, 48-49; Vol. 4, #4, 37; Vol. 8, #2, 94

Porter, W. T. - Vol. 4, #2, 28-31

Pratt, F. H. - Vol. 2, #4, 51-52

President-Elect Tour - Vol. 1, #3, 43-48; Vol. 2, #2, 61-63; Vol. 3, #2, 45-47; Vol. 4, #2, 22; Vol. 6, #2, 89-93

President's Message - Vol. 1, #2, 50-51; Vol. 1, #5, 49-55; Vol. 2, #4, 55-59; Vol. 3, #4, 10-13; Vol. 4, #4, 27-28; Vol. 5, #1, 29-31; Vol. 6, #1, 27-28

Program Advisory Committee - Vol. 5, #1, 31; Vol. 5, #2, 54-57

Prosser, C. L. - Vol. 1, #5, 45-48

Publications

APS Publications - Vol. 3, #2, 8-14

Board of Publication Trustees - Vol. 3, #2, 30

Editorial Procedures - Vol. 3, #2, 23-29

Journal of Neurophysiology - Vol. 5, #1, 10

Page Charges - Vol. 4, #1, 25-26; Vol. 5, #1, 10

Physiology for Physicians - Vol. 5, #4, 264; Vol. 7, #1, 5

Publication Policies - Vol. 6, #4, 324-327

Publications Report - Vol. 4, #2, 23-27

Reorganization of Publications - Vol. 4, #4, 29-38

Section Editors - Vol. 5, #1, 8-9

Style Manual - Vol. 4, #1, 23-24

Rahn, H. - Vol. 6, #2, 89-93; Vol. 7, #4, 334-342

Randall, W. C. - Vol. 4, #4, 51-56

Reed, C. I. - Vol. 4, #2, 34-39; Vol. 4, #4, 44-50; Vol. 5, #1, 35-40; Vol. 5, #2, 90-96; Vol. 5, #4, 300-307

Reeves, J. T. - Vol. 8, #4, 337

Regulation of Pulmonary Ventilation - Vol. 7, #4, 319-333

Renkin, E. M. - Vol. 7, #1, 13-28

Requirements for Medical School - Vol. 1, #5, 27-30

Research Obstacles in Colleges - Vol. 1, #3, 40-42

Research, Rewards in - Vol. 2, #1, 24-27

Respiration Suite - Vol. 6, #1, 47-48
Richards, D. W. - Vol. 1, #2, 32-37
Riddle, O. - Vol. 2, #2, 55-57
Riegler, G. D. - Vol. 8, #4, 336
Ring, G. C. - Vol. 1, #5, 37-42
Ringer, R. K. - Vol. 8, #4, 337-338
Romance of a Drop of Blood - Vol. 6, #4, 358-359
Russian Translations - Vol. 2, #2, 12-17; Vol. 3, #1, 47-48; Vol. 4, #4, 72-79

St. Clair, R. W. - Vol. 8, #4, 338-339
Saint Martin, Alexis - Vol. 6, #1, 63-65
Salisbury, P. F. - Vol. 8, #1, 48
Sayers, G. - Vol. 4, #1, 56-61
Schiller, J. - Vol. 2, #2, 50-54; Vol. 4, #4, 62-68
Schmidt-Nielsen, B. - Vol. 1, #2, 4-20; Vol. 5, #4, 257-263
Senior Physiologists - Vol. 1, #2, 28-30; Vol. 2, #2, 64-66; Vol. 4, #1, 27-34; Vol. 5, #2, 87-89; Vol. 7, #1, 42-44; Vol. 7, #4, 350-356; Vol. 8, #4, 353-364
Shamai, M. N. - Vol. 8, #4, 327
Share, L. - Vol. 8, #2, 68-72
Short, C. E. - Vol. 8, #4, 332-333
Silverman, M. - Vol. 2, #1, 24-27
Sizer, I. W. - Vol. 8, #2, 86-91
Smith, R. E. - Vol. 3, #1, 27-31
Society General Physiologists - Vol. 8, #3, 324
Sonnets Sans Bonnets - Vol. 8, #1, 46-47
Stevenson, J. A. F. - Vol. 7, #4, 305
Stone, F. L. - Vol. 3, #1, 32-38
Stübel, J. B. - Vol. 5, #4, 308
Symposia Abstracts
Approaches to the Neurochemistry of CNS Function - Vol. 8, #3, 321-323
Hypothermia - Vol. 8, #3, 313-320

Teaching Tour - Vol. 1, #3, 29-35
Temperature Regulation - Vol. 6, #1, 29-39
Thermistor and Intravascular Temperature - Vol. 3, #4, 63-69
Thermoregulation in the Goat - Vol. 8, #4, 333-334
Thirty-Minute Talks - Vol. 3, #4, 56-62; 63-69; 70-77; Vol. 4, #1, 56-61; 62-81; Vol. 5, #2, 65-86; Vol. 5, #4, 257-263; 270-284; 285-292; Vol. 6, #1, 29-39; Vol. 6, #2, 94-114; 115-120; Vol. 6, #4, 349-357; Vol. 7, #4, 305-318; 319-333
Thyroid Function - Vol. 6, #2, 94-114
Tipton, S. R. - Vol. 2, #4, 33-39
Tschorr, R. D. - Vol. 1, #2, 38
Twenty-Third Psalm for Respiration Students - Vol. 3, #4, 49

Van Liere, E. J. - Vol. 1, #3, 53-57
Vascular Changes in Experimental Hypertension in Swine - Vol. 8, #4, 338-339
Veterinary Medicine - Vol. 6, #2, 89-93
Visscher, M. B. - Vol. 3, #2, 15-22; Vol. 6, #1, 53-62; Vol. 7, #1, 29;

Vol. 7, #1, 32
Vivisection, Humane - Vol. 6, #2, 121-124

Walters, G. R. - Vol. 8, #4, 348-352
Washington Lingo - Vol. 4, #2, 32-33
Watson, The Physiological Doctor - Vol. 1, #3, 53-57
Wenzel, B. M. - Vol. 8, #4, 335-336
Wilber, C. G. - Vol. 8, #2, 67; 92-94
Will, D. H. - Vol. 8, #4, 337
Wilson, T. H. - Vol. 6, #1, 11-26
Wood, E. H. - Vol. 4, #1, 62-81

Yuwiler, A. - Vol. 8, #3, 321-323