CONTENTS

FRANK CHARLES MANN

1887 - 1962

Dr. Frank Charles Mann was born on the family farm in Adams County, Indiana, September 11, 1887. His early life on the farm conditioned him for his life-long habit of serious hard work and his curiosity about and love of nature. His early education was in the county grammar schools. He attended Decatur High School and after two years entered Marion Normal College from which he received a B.S. degree in 1907. His introduction to and interest in physiology began the next year at Indiana University where he served as assistant and teaching associate in the Department of Physiology from 1908 to 1912. He earned three degrees at Indiana, the B.A. in 1911, the M.D. in 1913 and the M.A. in 1914. He later received the honorary degrees of Sc.D. in 1937 from Georgetown College and the L.L.D. degree in 1938 from Indiana.

Frank Mann's early research interest in surgical shock while serving as Instructor in Experimental Surgery (1913-1914) under Dr. Gatch, Professor of Surgery at Indiana University College of Medicine was instrumental in having Dr. Gatch recommend him to the Mayo Foundation. He started as Director of Experimental Medicine and Pathological Anatomy at the Mayo Clinic. In 1915 with the integration of the Mayo Foundation into the Graduate School of the University of Minnesota, Dr. Mann became Assistant Professor of Experimental Surgery, Associate Professor in 1918 and Professor in 1928. He retained this position until his retirement in 1952. He served as Emeritus from 1952 to 1962.

In World War I Doctor Mann was commissioned second lieutenant in the Medical Corps and was assigned to give courses in surgical techniques for medical officers assigned for study at the Mayo Clinic. He also worked with the National Research Council in connection with its shock program. In World War II he again served the National Research Council in its surgical shock studies including the preparation of a guide for investigators.

Dr. Mann was very active in the affairs of the American Physiological Society. He became a member in 1916, served as Secretary from 1933 to 1936 and President from 1936 to 1937. He served on the Society's Board of Publication Trustees from 1946 to 1952. He helped establish the editorial Board of the Annual Reviews of Physiology and served as its chairman for many years. He was chairman of the Section on Pathology and Physiology of the American Medical Association in 1944. He was a member of numerous scientific societies and national committees. He received many awards and medals from various scientific societies .

Dr. Frank D. Mann, member of APS and son of Frank C. Mann was kind enough to supply most of the material used in the above sketch.

In his scientific research Dr. Mann combined the talent for recognizing significant problems with his extraordinary skill in experimental surgical techniques. He is probably best known for his studies in collaboration with McGrath and Bollman dealing with the physiology of the liver. His surgical skill made possible the study of hepatectomized animals. He established the crucial role of the liver in supplying glucose for the body in the fasting state and demonstrated the role of the liver in urea formation as well as the extrahepatic formation of bile pigment. In addition to his liver studies he made contributions to the pathogenesis of peptic ulcer, pancreatitis, cholecystitis, as well as other diseases of the digestive system. With Hiram Essex and others he studied the physiological effects of various animal venoms and toxins. He used his surgical skill in the employment of extra-vascularly placed flow meters in the study of organ circulation, including coronary circulation.

Dr. Mann was not only an excellent and talented investigator but he was a superb and understanding teacher. At the time of receiving an honorary doctorate of laws from his alma mater he gave his own definition of an ideal teacher. He said, "The ideal teacher, and I use the word in the broad sense, including all who instruct, is one who lives in the memory of his students long after most of the specific things he taught are forgotten. Not every scholar possesses those qualities which make him bigger than his subject, although I believe a higher percentage of teachers fulfill the ideal requirements for their work than any other profession. The most productive relationship of teacher and student is intangible: a rapprochement of the spirit, such as obtains between two old friends who through long association can carry on a soul-satisfying wordless conversation." To illustrate his strong belief that inquiry is an indispensable part of a valid educational experience he once said: "I do not believe that higher education can be made a thing apart from investigation without stunting the student's capacity to grow. A serious defect of those educational institutions which cannot afford necessary facilities for research is that their instruction is done so well the student acquires the view that all the facts about each subject have been learned. An individual with such a training frequently becomes so orthodox in his views he is not receptive to new ideas or advancement in the material, social or spiritual environments in which he must live. A heritage of a university training should make the recipient a leader in the nation but such leadership must be based upon the clearly recognized fact that the acquired knowledge of the past but points the direction for future advancement. If the experience of the last quarter century should have taught anything, particularly in the field of science, it is that much that is accepted as truth is relative and must always be considered in relation with time."

During his time at the Mayo Clinic, Dr. Mann encouraged and aided approximately 2,000 research studies and was author of about 400 papers. Dr. Mann played a major role in making the Mayo Foundation of the University of Minnesota a major center for training for academic medicine. Former Mayo Foundation Fellows occupy more medical faculty posts than do the graduates of any but a few institutions in the United States.

Dr. Mann's personal life was a happy one. He enjoyed gardening and cattle-breeding. He won many prizes for his peony and dahlia blooms and his Holstein-Friesian cattle herd was the envy of professional stockmen. After his retirement he devoted himself largely to floriculture and animal hisbandry. His death on September 30, 1962 was due to a malignancy of the pancreas, which he himself diagnosed, a disease with whose course and outcome he was professionally very familiar, yet he maintained his buoyant spirit to the end. Dr. Mann's influence on physiology and medical science will long be remembered.

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ABSTRACTS FOR FEDERATION MEETING

The American Physiological Society has the ruling of eliminating from oral presentation every n^{th} paper to reduce the number presented orally. For 1972 the reduced number was to be approximately 800 since more symposia (6) and more thirty-minute introductory talks (10) were to be programmed thus limiting space and time for ten minute papers. There were 971 abstracts received in this office in time to be considered for programming. Each abstract was given a number when received. By using the n^{th} method numbers were eliminated to bring the total considered for programming (including transfers to other societies as requested by the author) to 831.

Most of the other societies have some system of selecting abstracts for oral presentation. They do this after transfers thus some papers transferred to other societies from APS may be rejected. APS will not accept transfers from other societies to APS that we cannot program for oral presentation.

This year there were 22 abstracts received in this office too late to be considered. Some were mailed too late and others were evidently delayed in the mails. Again we emphasize the fact that abstracts should be mailed early and always sent by airmail, special delivery.

AN INVITATION FROM THE PRESIDENT

J. R. BROBECK

Concern and even anxiety about the future of our science, including what might become of the American Physiological Society, are shared by many of our members. It is my own impression that the destiny of the science per se may be beyond our control, inasmuch as it will be determined by the ongoing of research in our own and in many other laboratories. But the welfare of the Society is very much in our power to influence, it being the responsibility of our officers, the Council, and ultimately of all members of the Society.

One of the most critical considerations relative to the future of the Society is the question of who should be elected to membership. The bylaws state that a regular member shall be, "Any person who has conducted and published meritorious original research in physiology, who is presently engaged in physiological work, and who is a resident of North America..." Yet because the science is so broad and so nearly ubiquitous in both medical research and in biology, these criteria often leave the Membership Advisory Committee and the Council uncertain as to approval of membership applications.

In an attempt to provide some clarification of the wishes of the Society, an informal discussion of qualifications for membership is planned for the second session of the annual business meeting on Wednesday, April 12, at 4:30 PM. Dr. James Preston and Dr. Alan Herd, past and present chairmen of the Membership Advisory Committee, and Dr. James Metcalfe, a member of that Committee, will lead this discussion. All members are invited to attend and to participate.

SIXTEENTH BOWDITCH LECTURE*

The Physiology of Strong Emotions: Cannon's Scientific Legacy Re-examined

J. ALAN HERD
Dept. of Physiology
Harvard Medical School

One hundred years ago, on October 19, 1871, Walter B. Cannon was born in Prairie du Chien, Wisconsin. He grew up and attended school in Minnesota, eventually entered Harvard University where he graduated summa cum laude in 1896, and graduated with the M. D. degree from Harvard Medical School in 1900.

Although Cannon contributed a wealth of scientific information, it is his study of emotional behavior that I wish to review today, for it was Cannon who first described the physiological mechanisms wherein behavioral phenomena might promote organic disease. He first described what is now called the "defense-alarm reaction" and he postulated the deleterious organic effects of physiological reactions in modern man unable to counter environmental threats by physical activity. In 1971, Cannon's hypothesis still has not been thoroughly tested but I will describe some experiments underway at Harvard Medical School which suggest that behavioral phenomena may induce organic disease.

At the fiftieth anniversary of the American Physiological Society celebrated in 1938, Cannon spoke of events leading to formation of the Society and shaping his own career as a physiologist (9). He began his account with the appointment in 1871 of Henry Pickering Bowditch to the newly formed Department of Physiology at Harvard Medical School. Before 1871, physiology at Harvard Medical School had been taught by Oliver Wendell Holmes who was Parkman Professor of Anatomy and Physiology. In the academic year 1870-71, Charles Eliot, newly appointed President of Harvard University, established a separate Department of Physiology. In April 1871, Bowditch accepted an appointment to the newly formed department and began, in the fall of that year, as Assistant Professor of Physiology. Today, 100 years after Bowditch's appointment, on the occasion of the 16th Annual Bowditch Lecture and the 100th anniversary of Cannon's birth, I should like to recount some of the scientific events shaped by Bowditch and Cannon which in turn have led to current concepts about behavioral control of physiological phenomena.

When Cannon, as a first year medical student consulted Bowditch about possible lines of research he might follow, Bowditch suggested that the newly discovered roentgen ray tube might help resolve the question.

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*Presented on August 18, 1971 at the University of Kansas, Lawrence. Work described in this report was supported by USPHS Grant Nos. HE 09154 and HE 13346 and by the Council for Tobacco Research - U. S. A.

about whether the force of swallowing moved food along the esophagus or whether peristaltic waves in the esophagus provided the predominant force (3). In December 1896, Cannon observed the movement of x-ray opaque buttons down the esophagus of a dog. In 1897, while still a medical student, Cannon introduced the use of bismuth salts in radiology and recorded the first observations under x-ray of peristaltic waves passing over stomach contents (5).

Early in his research on gastric motility, Cannon observed marked differences in movements of the stomachs of male and female cats (5). The peristalsis seen with only a few exceptions in female cats failed to appear in most of the males. On account of this difference, only female cats were used for some time and the differences ignored until observations on one female subject explained the absence of gastric movements in males. While the peristaltic undulations were coursing regularly over the cat's stomach, she suddenly changed from her peaceful sleepiness, began to breathe quickly, and struggled to get loose. As soon as the change took place, the movements in the stomach entirely disappeared. When the cat was stroked for a few moments, she began to purr, whereupon the movements commenced again in the stomach. In general, male cats were restless and excited on being fastened to a holder above an x-ray tube and gastric peristaltic waves were usually absent. The female cats usually remained calm under restraint and had normal gastric motility.

In many subjects, inhibition of gastric peristalsis persisted long after the animal had ceased struggling (6). Cannon was well aware of Pavlov's work showing that the vagal nerves of the autonomic nervous system were concerned in the psychic secretion of gastric juice. He was also aware of Langley's work showing the distribution of sympathetic and parasympathetic nerves to all viscera including the adrenal medulla. Cannon deduced that excitement might provoke a flow of adrenal medullary secretion, and that changes originally induced in the digestive organs by nervous impulses might be continued by circulating adrenalin (7). Whether that idea was correct or not was not then tested. Its importance lay in leading to the inquiry whether the adrenal glands are stimulated to secrete during emotional excitement.

A study of Cannon's recently discovered diary (4) reveals that in the fall of 1910, Cannon and de la Paz were eagerly at work testing for the secretion of adrenalin in cats. On January 16, 1911, Cannon wrote, "This is a hallelujah day! De la Paz and I get clear evidence of emotional production of adrenalin in cat." In those experiments, a cat, fastened in a holder similar to the one used for x-ray studies of the stomach, was placed near a barking dog. Some cats when thus treated showed few signs of fear, while others presented the full typical picture. The dog was allowed to bark at the cat for five or ten minutes and then the dog was removed. Samples of blood were drawn from the inferior vena cava of the cat just proximal to the adrenal veins within a few minutes before and after the period of excitement. By using as a bioassay, a strip of intestinal muscle sensitive to dilute solutions of adrenalin, they were able to show that when a dog barks at a cat, and the cat reacts by signs of terror or by a raging counterattack, the cat's blood taken near the

opening of the adrenal veins contained an increased concentration of adrenalin (11). All degrees of relaxation could be duplicated by adding varying amounts of adrenalin to blood from quiet animals.

Several years later in the process of developing a more convenient assay for adrenal medullary secretions, Cannon introduced a technique based on supernormal sensitivity of the denervated heart to circulating adrenalin. He demonstrated that after surgical removal of all the nerves to an animal's heart, the heart continued to beat normally but after several days the rate at which the heart beat became exquisitely sensitive to adrenalin circulating in the blood (12). Whenever small amounts of adrenalin were injected intravenously, the rate at which the denervated heart beat was increased. Cannon used cats surviving denervation of the heart to demonstrate that adrenalin was discharged when strong emotion was aroused. When a cat with a denervated heart was resting quietly, heart rate was approximately 120 beats per minute. When a barking dog was brought near the cat, the response of the cat included acceleration of the heart rate to approximately 160 beats per minute. When great excitement was accompanied by vigorous struggle, the denervated heart increased its rate to approximately 200 beats per minute. After removal of the adrenal glands, repetition of the same conditions with the same animals induced only minor cardiac accelerations or none at all.

On April 22, 1911, Cannon wrote in his diary, "Gave paper on effects of emotion on adrenal secretion and glycosuria - with theory of utility in wild life. Crile (14) followed with bad effects of fear. Paper headline, 'Don't get scared, it's too dangerous!' Got idea that pathological effects of emotion due to failure to have normal exit in muscular movement."

Throughout his studies on the physiology of strong emotions, Cannon considered only the physiological response of the subjects tested. In 1936, he wrote (8) "I propose that we try to keep out of the foggy realm of metaphysical medicine and consider emotions from the physiological point of view. Although I shall use words which designate subjective states, such as 'fear', 'rage', and others, let it be understood that I use them only as convenient abbreviations for activities in the nervous system."

In all of Cannon's early studies, he used the natural antagonism between dogs and cats to induce excitement. In a typical experiment, a cat was confined in a small wire cage where it was protected from injury and where its muscular activity was restricted. After control samples of blood had been obtained, a lively noisy dog was brought near the cat and allowed to bark at it for a few minutes. The dog was then taken away and a second sample of blood drawn. Repetition of the procedure frequently resulted in a gradually increasing indifference of the cat safe in its cage to the barking dog outside. These uncertainties of behavioral reactions to natural stimuli troubled Cannon (10) and continue to trouble physiologists intent on inducing strong behavioral reactions over long periods of time.

A technique for inducing emotional excitement over long periods of time was suggested to Cannon by the work of Woodworth and Sherrington (20) in which they described the behavior of animals whose brains had been cut through the middle of the brain stem. Responses to stimulation of sensory nerves included movements of the legs, turning of the head and neck, snapping of the jaw, dilatation of the pupils, snarling, and an increase of arterial blood pressure. Cannon proposed that removal of just the cerebral cortex might permit these behavioral phenomena to appear without producing the skeletal muscle rigidity which usually masks most of them when the mid-brain is transected behind the diencephalon (10). In addition, destruction of the cerebral cortex eliminated conscious appreciation of sensation and therefore eliminated the need of an anesthetic. These phenomena could then be studied experimentally over long periods of time.

To remove the cerebral cortex without destruction of the basal ganglia, Cannon approached the brain by way of the orbits. The plane of section passed about midway through the orbital lobe, obliquely across both cerebral hemispheres just behind the motor cortex cutting through the front of the corpus callosum and some of the thalamus. When the operation had been completed, characteristic behavioral phenomena appeared spontaneously which Cannon described as "a sort of sham rage." These included lashing of the tail, arching of the back, clawing actions, attempts to bite, rapid respiration, erection of the tail hairs, sweating of the toe pads, dilatation of the pupil, and an elevated blood pressure ranging from 140 to 200 mm Hg. In addition, the rate of the denervated heart was increased. Since the increase in rate of the denervated heart was not seen if the adrenal glands had been removed, Cannon inferred that the adrenal medulla participated in the general widespread discharge of sympathetic impulses in sham rage.

Subsequent experiments by Bard (1) demonstrated that typical sham rage regularly developed after removal of all parts of the brain rostral to the caudalmost portion of the diencephalon. Since signs of sham rage invariably failed to appear after high mesencephalic transections, it was concluded that sham rage in the cat is dependent upon central mechanisms which are located in the posterior hypothalamus.

In summary, Cannon's scientific contribution to the physiology of strong emotions was the description of sympathetic and adrenal medullary activation as part of excitement, and his observation of sham rage in decorticate cats was a forerunner of the observations by Hess (18) and others following electrical stimulation of the posterior hypothalamus. He also postulated that prolonged stimulation of the sympathetic nervous system might induce organic disease (8). However, many questions were left unanswered. Cannon studied reactions to extreme stimuli over short periods of time. He conceived of the sympathetic nervous system as reacting only in emergency and then in a stereotyped manner (13). We now know that the sympathetic nervous system is more or less active at all times and capable of discrete as well as generalized responses.

During the past several years, a group of us at Harvard Medical School has been studying the long term effects of behavioral phenomena in subhuman primates. Because the cardiovascular system responds quickly to environmental stimuli, we have used continuous measurements of systemic arterial blood pressure and heart rate to quantitate reactions to various behavioral procedures. The objective of our experiments has been to induce consistent cardiovascular responses to environmental stimuli over periods of many months. Those behavioral procedures most effective in producing hypertensive responses are now being tested for their possible role in the pathogenesis of hypertensive and arteriosclerotic cardiovascular disease in subhuman primates.

The subjects used in the majority of our experiments are squirrel monkeys. They are New World monkeys that weigh about 750 grams and have a head and body length of about 30 cm. With the aid of halothane-oxygen anesthesia, one end of a small polyvinyl chloride catheter is implanted into the aorta through the right internal iliac artery (17). The other end of the catheter is brought out through the skin in the middle of the back and protected by a leather jacket which each monkey wears at all times. After the animals have recovered from surgery, arterial blood pressure is measured with each animal in its home cage or seated in a restraining chair in a soundproof isolation chamber. The implanted catheter of the monkey is connected to a constant infusion syringe pump and the output of the strain gauge pressure transducer is amplified and recorded on a polygraph. A solution of heparin and saline is infused continuously at a low rate through the gauge and tubing. During experimental sessions, each monkey is restrained in the seated position by a waist lock and its tail held motionless by a small stock. Electric current can be delivered through the tail by two hinged brass plates which rest lightly on a shaved portion of the tail. Electrode paste ensures a low resistance electrical contact between the plates and the tail. A liquid food dispenser is mounted behind a recessed area in a transparent lucite wall in front of the monkey. A response lever is mounted to the right of the food dispenser and small colored lights used as visual stimuli are mounted above the front of the chair.

After control blood pressures have been measured, various schedules of environmental stimuli are presented to the monkeys. Figure 1 shows the changes in mean blood pressure that occurred when food was presented to a fasted animal. During the experiment which lasted approximately 15 minutes, small amounts of liquid food were presented to the monkey approximately three times per minute. These presentations were associated with a rise in mean arterial blood pressure that approximated 40 mm Hg and lasted throughout the session. However, this experiment could be run only once each day because this amount of food satiated even a fasted animal. Presenting the food less frequently increased the time the experiment could be run but arterial blood pressure rose less.

Figure 2 shows the changes in blood pressure that followed a noxious electrical stimulus presented every four minutes. The first mark made by the event pen indicates the time a buzzer was turned on and left on. The next mark made a few seconds later indicates the superimposition

of a noxious electric stimuli maintained until the time the third mark was made several seconds later. A small rise in blood pressure occurred when the buzzer sounded and a larger rise occurred during the delivery of noxious stimuli. After cessation of these stimuli, blood pressure fell markedly for several seconds. With repeated presentations, the elevations of blood pressure noted when the buzzer sounded and when the noxious stimuli were delivered, gradually decreased.

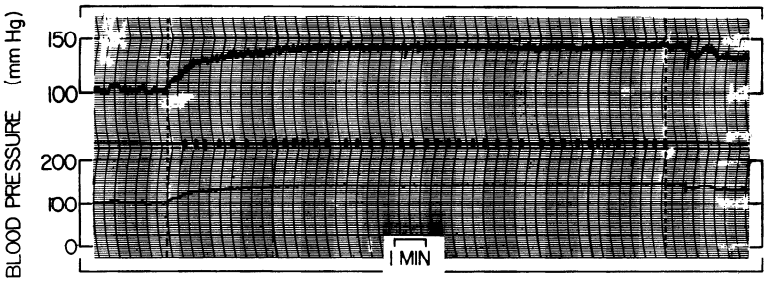

Fig.1. Polygraph records of systemic arterial blood pressure in monkey S-89 previously deprived of food, measured during presentation of a light associated with delivery of food. Top and bottom records were recorded simultaneously from the same pressure transducer using different output voltage amplification and different amplifier low-pass filtering. Upward deflections of the event marker indicate times during which food was presented to the monkey. Dashed vertical lines across top and bottom records at left and right of the figure indicate the time during which a panel light was turned on and lever-pressing responses were followed immediately by the delivery of food.

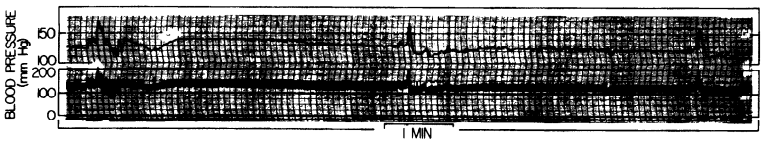

Fig.2. Polygraph records of blood pressure obtained during periodic presentation of noxious electric stimuli to monkey S-108. Top and bottom records were recorded simultaneously from the same pressure transducer.

Any stimulus presented repeatedly has a gradually diminishing effect on behavior. This is true for presentation of food or noxious stimuli. Elevations of blood pressure during classical conditioning experiments all tended to decrease in amplitude and duration as stimuli were repeatedly presented. Our early observations were reminiscent of Cannon's experiments in which strong reactions to natural stimuli were short-lived.

Operant conditioning procedures, which involve the scheduling of environmental events according to the responses of an experimental subject, exert a more lasting control over behavior than that usually obtained by classical conditioning (15). For example, if an animal oc-

casionally receives noxious stimuli in the presence of a light and lever-pressing responses turn off the light, the animal will tend to respond by pressing the lever over long periods of time whenever the light is on even though noxious stimuli are only infrequently delivered (19). It seemed possible to us that these same procedures might also exert lasting effects upon the cardiovascular system.

Animals were trained to press a lever under a schedule in which noxious electric stimuli were delivered periodically in the presence of a panel light (17). Results of a typical experimental session are illustrated in Figure 3. When the panel light came, the monkey pressed the lever and mean arterial blood pressure and heart rate increased. When the required number of responses had been made, the light automatically was turned off, the animal stopped responding, and blood pressure and heart rate decreased. This pattern of lever-pressing and these patterns of blood pressure and heart rate occurred consistently in most animals.

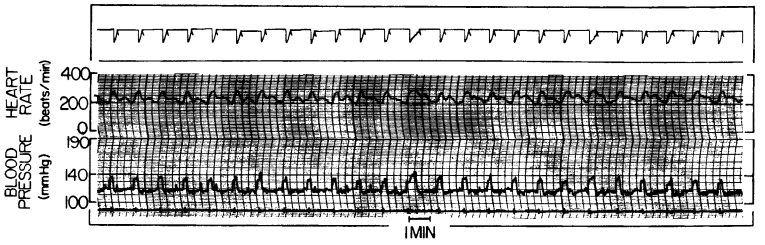

Fig.3. Characteristic patterns of lever-pressing and changes in heart rate and mean arterial blood pressure in monkey S-110 under a schedule in which noxious stimuli were scheduled to occur every 30 sec in the presence of a panel light and in which the 30th response turned off the light. Top record shows cumulative recordings of lever-pressing responses. Slope of cumulative record is directly related to rate of lever-pressing. Recording pen reset to bottom of record when light was turned on automatically. Short diagonal strokes show where the light was turned off and 1-min time-out period began. Top polygraph record is heart rate and bottom polygraph record is blood pressure.

These elevations of arterial blood pressure were not merely the effect of physical activity associated with pressing a lever because elevations of blood pressure continued even after the lever had been removed from the chair (2). In Figure 4, the top half shows the changes in arterial blood pressure observed when an animal pressed a lever in the presence of a panel light. The bottom half shows changes observed in the same animal in the presence of a panel light presented periodically while the animal sat motionless in the chair after the lever had been removed.

Other animals were continued in daily sessions in which they were required to press a lever to turn off a light (17). After many daily sessions, blood pressure was elevated throughout each session not only

during periods of responding but also during time-out periods. In Figure 5, records A and B were obtained 126 days after training began and C and D were obtained after 162 days. In both sessions, the monkey pressed the lever at a high rate and no noxious stimuli were delivered during the time these data were recorded. Blood pressure was markedly elevated on Day 162.

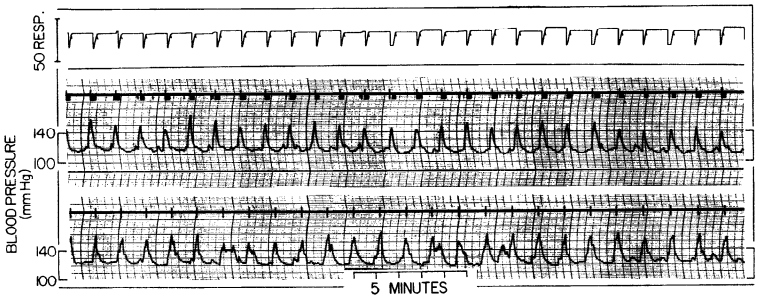

Fig. 4. Mean arterial blood pressure in monkey S-144 during behavioral experiments in which noxious stimuli were scheduled to occur in the presence of a panel light. Top polygraph record is blood pressure measured under the same behavioral schedule described in figure 3. Bottom polygraph record is blood pressure measured in the absence of a lever under a schedule in which a panel light occasionally associated with noxious electric stimuli was turned off 1-4 sec after blood pressure had risen 5-10 mm Hg above the level recorded during time-out periods. (From Benson et al. (2).)

Figure 6 shows a summary of data obtained from the same subject over a period of several months. The data at the top are the average mean blood pressures recorded during the whole of each experimental session and include all time-out periods as well as periods of responding. The data in the middle show the average rate of lever-pressing when the panel light was on, and the data at the bottom show the rate at which noxious stimuli were delivered. There was no simple relation between the daily mean arterial blood pressure and the rate at which noxious stimuli were delivered. However, there was a direct relation between the rate at which the monkey pressed the lever and the level of mean arterial blood pressure. All animals received the greatest number of noxious stimuli in the early stages of their training but arterial pressure was little elevated at that time. Sustained hypertension occurred only when each subject's behavior was powerfully and continuously controlled by scheduled environmental stimuli.

Continuous measurements of blood pressure 24 hours a day revealed that elevations of arterial blood pressure induced by behavioral techniques persisted between experimental sessions (16). Data were obtained from each of 18 animals in its home cage by means of a system of pressure transducer, fluid infusion pump, infusion line, and fluid swivel. In Table 1 are listed the control mean blood pressures of 11 animals later subjected

to behavioral procedures and 7 animals not subjected to behavioral procedures. The average mean blood pressure measured in all 18 animals before any training began was 125 mm Hg. During a subsequent period, approximately four months later, average mean blood pressures were again recorded continuously 24 hours a day. The values listed are averages of all data recorded continuously both during daily two hour behavioral procedures in an isolation chamber and in the home cage during the rest of each day. During these experiments, control animals were maintained in the same way as the animals subjected to behavioral procedures including daily flushing of the intra-arterial catheter in each monkey. In control animals, no consistent change in average mean blood pressure was found but animals subjected to behavioral procedures had significant elevations of mean arterial blood pressure that persisted between daily sessions.

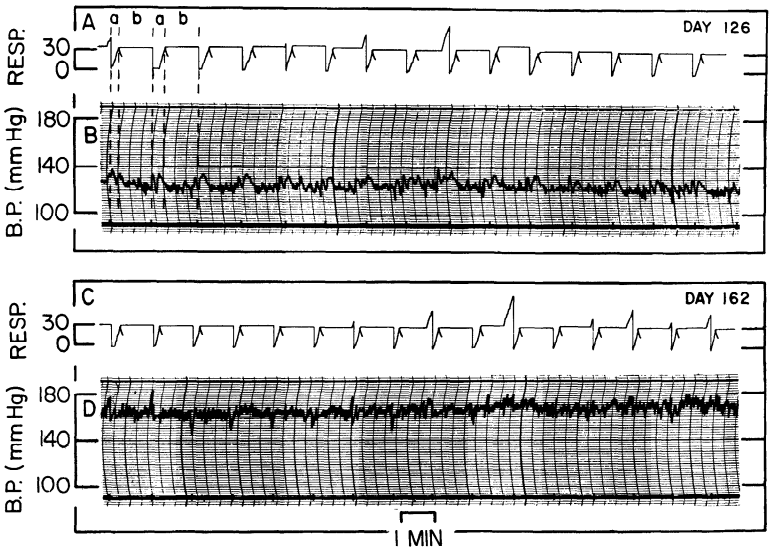

Fig.5. Mean arterial blood pressure in monkey S-116 on day 126 (A and B) and day 162 (C and D) under the same behavioral schedule described in figure 3. Light was turned on automatically at beginning of period a and turned off during period b. (From Herd et al. (17).)

On days in which behavioral procedures were performed, arterial blood pressure was highest in the isolation chamber. During the rest of each day, blood pressure declined to levels slightly lower than those recorded during each session. Subjects which had much higher levels of blood pressure in the isolation chamber than during the rest of the day had their lowest levels of blood pressure recorded immediately after removal from the isolation chamber. Data in Figure 7 was obtained from a squirrel monkey trained under a schedule in which food was presented intermittently following lever-pressing in the presence of a panel light. The closed circles are data recorded continuously

before training began. The closed triangles are data recorded continuously during the period approximately four months later which included daily behavioral sessions. Blood pressure was highest during each daily session, fell to a low value following daily sessions and then rose gradually up to the time of the next daily session.

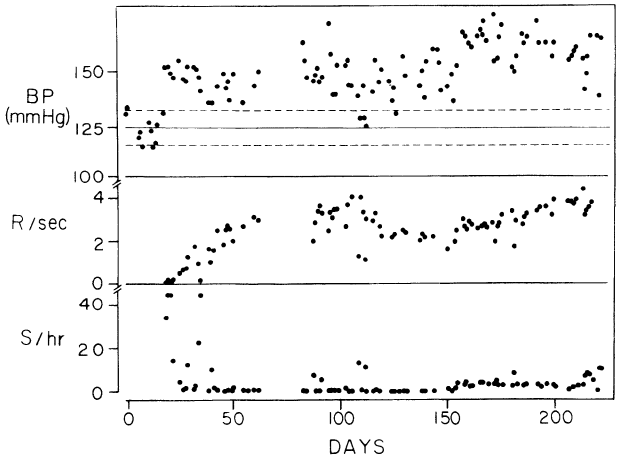

Fig.6. Daily mean blood pressure in monkey S-126 during prolonged training under the behavioral schedule described in figures 3 and 5. Top scatter diagram shows mean arterial blood pressure in mm Hg (BP), middle diagram shows rate of lever-pressing in responses per sec (R/sec), and bottom diagram shows rate of delivery of noxious stimuli in stimuli per hour (S/hr). In the top diagram, solid horizontal line indicates mean arterial pressure during control period, and dashed horizontal lines indicate 1 SD from mean. (From Herd et al. (17).)

TABLE 1

Mean arterial blood pressure during continuous 24 hour periods.

	Trained Subjects n=11	Control Subjects n=7	All Subjects n=18
Initial Period (mm Hg)	124 ± 2.5*	127 ± 2.8	125 ± 1.9
Subsequent Period (mm Hg)	144 ± 3.2	126 ± 3.8	
Change in B.P. (mm Hg)	20 ± 3.2	-1 ± 1.6	
Daily Sessions (mm Hg)	151 ± 4.1		
Total Days of Observation	116 ± 10.9	138 ± 6.5	125 ± 7.5

*Values are mean ± SE.

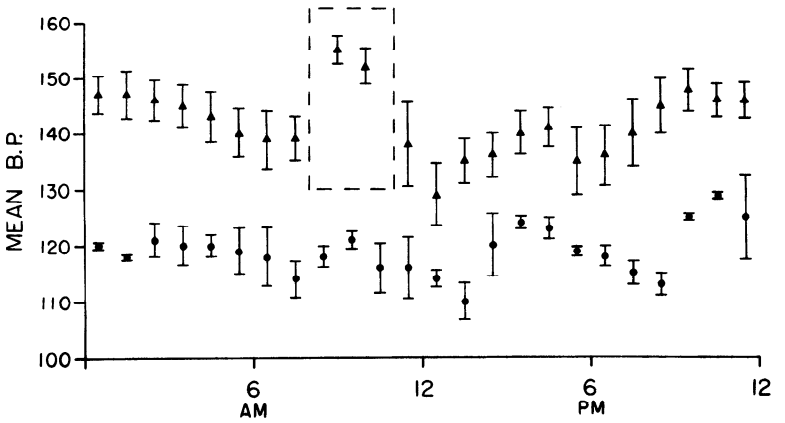

Fig.7. Arterial blood pressure in monkey S-139 recorded continuously 24 hours a day before (closed circles) and during training (closed triangles) under a schedule involving presentation of food following lever-pressing responses in the presence of a panel light. Vertical lines and bars indicate 1 SE of the hourly means. The dashed lines surround data recorded during two hour sessions in the isolation chamber.

In summary, the results of these experiments indicate that environmental stimuli can induce sustained arterial hypertension in squirrel monkeys. Apparently the effects of these behavioral procedures are not due simply to the delivery of noxious stimuli. All animals received the greatest number of noxious stimuli during the initial stages of their training but arterial blood pressures were little elevated above control values. As training progressed and each animal began to press the lever rapidly, the number of noxious stimuli delivered gradually decreased but mean arterial blood pressure rose. Eventually mean arterial blood pressure was elevated before, during, and after each session even if noxious stimuli were not delivered. Those behavioral procedures which exert strong control over an animal's behavior, also induce marked and persistent elevations in systemic mean arterial blood pressure. Perhaps hypertensive and arteriosclerotic cardiovascular disease occur in susceptible individuals as part of their response to environmental stimuli which have a powerful effect on each individual's behavior.

In retrospect, Cannon's hypothesis that strong emotions might induce organic disease seems entirely reasonable but it has taken 60 years to develop behavioral techniques for exerting sustained control over physiological phenomena. The idea stated in Cannon's diary that pathological effects of emotion are due to failure to have normal exit in muscular movement can now be tested prospectively in subhuman primates.

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THE PHYSIOLOGY TEACHER - A PROGRESS REPORT AND A REQUEST

N. MILBURN, B. CURTIS, P. CROOK
AND O. REYNOLDS, EDITORS

The Physiology Teacher, newest publication of the American Physiological Society, began with the April 1971 issue. This small quarterly was founded in response to a concern expressed to the Education Committee by teachers of collegiate undergraduate courses in physiology. The teachers felt a need for a source of information about current physiological topics, laboratory experiments and demonstrations and a forum for discussion of problems connected with the teaching of physiology.

Each issue of the publication has carried an experimental protocol. There has been a column of "Questions and Answers" which presented short discussions of topics suitable for incorporating into physiology lectures. These have included such topics as the physiological events leading to death from drowning and a discussion of the functional role of brown fat. Book reviews of texts in physiology and of volumes which might serve as the basis for seminars are carried, as are articles dealing with new methods of presentation of physiology to students. Announcements of workshops and society refresher courses and a modest amount of advertising, particularly advertisements of laboratory devices suitable for use in teaching are also included. We anticipate the addition of new features and welcome suggestions from physiologists and teachers of physiology as to what may interest them.

The first two issues of The Physiology Teacher were distributed free to a mailing list of 30,000 individuals. The response to these issues was excellent. Sufficient subscription orders followed so that the journal will be self-supporting in 1972. (The time of the editors is, of course, contributed and the APS staff time is not charged against the publication's budget). Advertising has not been pursued aggressively but has been accepted when it provides information useful to the readers. The income from advertising has enabled us to improve the quality of the printing and format and to occasionally increase the size of the publication from eight to sixteen pages.

At the present writing it appears that subscriptions, advertising, and a most welcome subsidy of $3,000 from the Harvard Apparatus Company will result in the first six issues, including the two promotional issues, being published and distributed at no monetary expense to the APS membership.

However, the APS members must be relied on for a different type of contribution. They represent the source of the necessary content material to make The Physiology Teacher a continuing success. The most important item in each issue is a well-described physiology laboratory experiment.

Experiments so far presented are:

"Control of Respiration Studied by Voluntary Apnea (Breath Holding)".

Brian A. Curtis, Tufts University

"Individualities of Smooth Muscle Function and Control: A Comparison of Aortic Muscle and Longitudinal Muscle of the Small Intestine".

David F. Bohr, Univ. of Michigan

"Action of Antidiuretic Hormones and Its Intermediate, Cyclic AMP, on Water Reabsorption from the Toad Bladder".

G. A. Rinard and J. D. Neill, Emory University

"Autorhythomometry - Procedures for Physiologic Self-Measurements and Their Analysis".

Franz Halberg, Eugene A. Johnson, Walter Nelson, Walter Runge and Robert Sothern, Univ. of Minnesota

"A Classroom Method for the Determination of Oxygen Dissociation Curves of Hemocyanins".

John J. Poluhowich and Peter Krinsky, Univ. of Bridgeport

Similar experiments which do not require expensive and complex equipment are needed for future issues. These should be 12-13 double-spaced pages in length, including figures. Short (3-4 pages typed double spaced) papers on educational experiments, useful teaching equipment, materials and methods are desired. Questions (and answers) on physiological topics of current interest, and book reviews (1-2 pages) would also be gratefully received.

A recent analysis of the subscription list showed 64% of the subscribers to be in the undergraduate departments of colleges and universities; 12% are affiliated with medical school departments, 2% are in unaffiliated health professional schools and 3% high schools. A group of 5% are in hospitals, research institutes and Governmental laboratories and 14% of subscribers are individuals whose address does not indicate their affiliation. (Many of these we know are teachers or physiologists subscribing at home). 98% of the subscriptions are from North America, the remaining 2% being widely scattered to all continents.

The members of the APS have, through the medium of The Physiology Teacher, an opportunity to exert an impact on education in physiology at several levels in our society. With your help the editors hope to meet this challenge.

THE REGIONAL RESOURCE CENTER: A WAY TO IMPROVE THE TEACHING OF HUMAN PHYSIOLOGY AT THE HIGH SCHOOL AND COLLEGE LEVEL

JACK L. KOSTYO
Chairman, APS Education Committee

Physiology consists of a pool of information, much of which should be part of the common knowledge of every member of our Society. Every man should have some basic understanding of how his body works. Indeed, with our present system of health care delivery an individual needs to have at least some rudimentary knowledge of the functioning of his body in order to seek the right medical specialist for his particular problem.

Unfortunately, the average citizen, even the beneficiary of a college education, has little knowledge of how the human body works. In recent years there has been a swing away from the study of human biology in the public schools. We are all aware of the emphasis that molecular biology has received in high school and college biology curricula. In fact when the present series of BSCS textbooks for high school biology were prepared, a deliberate effort was made to avoid the use of examples from human biology. This was done to give the student a better appreciation for the common threads that run through the biology of the plants and animals.

Where then does human physiology fit into present high school and college curricula? When human physiology is included in the high school curriculum, it is usually taught as part of a health and hygiene course. Such health and hygiene courses are frequently included in the physical education program. In general, the textbooks used in these courses are woefully inadequate. Unfortunately, the quality of instruction given is little better. At the college level things are not much better. Admittedly, at some colleges, excellent courses in human physiology are offered, but this is the exception rather than the rule. Usually, human physiology is taught by the physical education department, a group often ill equipped by training and experience to do an adequate job.

Certainly, the physician does not and cannot be expected to contribute much to the education of the general public in the area of human physiology. His time is completely consumed in meeting the medical needs of the community that he serves. Professional physiologists, like the physician, have the information that the public needs, and more importantly, many have the experience and skills necessary to teach it. What is needed is a way to make the knowledge and talents of the professional physiologist available to the community, a way that will require a limited input of time but one that will yield the maximum benefit for the public.

One possibility that comes to mind immediately is that physiologists could participate in the preparation of stronger texts in health and hygiene. Better still, physiologists might help prepare a unit to be added to the BSCS high school biology textbook series which would emphasize human biology. Since this seems to be a particularly fruitful approach, the APS

Education Committee is currently exploring ways to catalyze the production of such a human biology track in the BSCS textbook series.

But there is another way that physiologists can make their knowledge available to the community. At a recent meeting of a sub-committee[1] of the APS Education Committee which was convened to consider problems in the teaching of human physiology, it was proposed that there be established Regional Resource Centers to improve the teaching of physiology in high schools and colleges in diverse areas of the nation. The Resource Center would be a place where professional physiologists would make their broad range of expertise and their supporting facilities available to the educational community in their area for the purpose of improving the quality and scope of education in human physiology. Actually, the Center could function in a variety of ways.

First, the Center should assess the actual status and quality of education in human physiology in its geographical area. This could be achieved through discussions with local boards of education, school health authorities, the PTA, teachers and students. Assessment of the depth of understanding of human physiology among the general public might be made with tests of people in different age groups, for example at the eighth grade level, high school level, college level, etc. Actually, this might be accomplished through television, perhaps with a "Do you know your body?" test. Gathering information of this sort would be essential to the planning of an intelligent approach to the upgrading of education in physiology. Furthermore, it would be very valuable in persuading school boards and school administrators that improvement is needed and that physiologists can help make the needed improvements.

Improvement in the teaching of human physiology could be facilitated by the Regional Resource Center in a number of ways. The Center could offer special lectures, demonstrations, refresher courses or workshops to teachers at the high school or college level who are involved in teaching human physiology. Teachers could be introduced to university libraries in their area, made aware of the availability of audiovisual materials on physiological subjects and given help in obtaining chemicals, drugs and other materials that they might need to put on demonstrations in their courses. Opportunities could be made available for teachers or students to participate in summer research programs. Finally, members of the Center could participate in local radio or television efforts designed to increase public understanding of physiological principles.

Quite obviously, such Regional Resource Centers could contribute greatly to a rapid and effective improvement in the understanding of

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[1]Members of this sub-committee were: Ingrith Deyrup-Olsen (U. of Washington), Chairman; Don P. DeMyers (Federal City College); Patricia N. Farnsworth (Barnard College); James P. Filkins (U. of Tennessee); Ellen O. Fuller (Emory U.); John A. Johnson (U. of Minnesota); Manert H. Kennedy (Biological Sciences Curriculum Study, Boulder, Colorado); Jack L. Kostyo (Emory U.); Robert T. Schopp (S. Illinois U.); and James H. Sherman (U. of Michigan).

human physiology at every educational level. But how can such Regional Resource Centers be established? Such Centers actually exist now, in strong physiology departments in universities throughout the country. What is needed is the interest and desire on the part of these departments to make their resources available to those in the surrounding community that need those resources.

Clearly, a department of physiology would have to make a major effort, at least initially, to establish contacts with teachers, students and administrators at all appropriate educational levels, to assess needs and to work out solutions to problems. These activities would unquestionably place major demands on a department's manpower and facilities. But compensating for this investment of time and effort would be a clearer definition of the department's important role, not only in its parent university, but in the community. It would also undoubtedly widen the possibilities for the employment of young physiologists in the area. Further, efforts by the department to improve the basic understanding of physiology at every level would be rewarded in the long run by improved preparedness of students coming to the department for graduate, medical and allied health education. And finally, the department and thereby its parent university would be making a direct and significant contribution to the life of the community.

The APS Education Committee is eager to learn your reaction to the Regional Resource Center concept. In particular, we hope that some departments of physiology will be willing to test the Resource Center concept on a pilot basis. The Education Committee is anxious to work with interested departments to devise the detailed methods of approach that will be needed to establish a department as a Resource Center. In addition, the Committee will also serve as a coordinating body to provide interchange of ideas and results among Centers and to evaluate the success of the concept. If you are interested in the Resource Center concept, please send us your opinions and comments.

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EVALUATING AND IMPROVING A COURSE IN MEDICAL PHYSIOLOGY

D. T. FRAZIER and J. D. HOLCOMB
Univ. of Kentucky College of Medicine

During the spring semester of 1971, the Department of Physiology and Biophysics engaged in a project designed to improve the teaching techniques of their faculty, the content of the course and the procedures used for evaluation of students. Basically, the project consisted of three components. They were as follows:

1. Improving lecturing abilities by having lectures video-taped for self-evaluation by a professional staff member.

2. In-depth analysis of examinations given in the course to the extent that both faculty and students can determine areas where improvement of teaching by the faculty may be warranted and additional study by the students is needed.

3. Contacting members of clinical departments to discuss the content of the Medical Physiology course.

At the University of Kentucky College of Medicine, Medical Physiology is a first year course. It covers sequentially the physiology of the various systems of the human body. Within the framework of this course the study described below was conducted.

Video-taping Lectures for Evaluation

It was decided that one method of improving teaching was by self-evaluation through the use of video-taped recordings. The faculty members who had teaching roles in the medical physiology course were asked to participate and eight (75%) volunteered to have one of their lectures video-taped.

The use of video-tape recordings for self-assessment has been found very effective in preparing elementary and secondary school teachers (1). Also, many medical educators have found it very helpful in developing medical students' skills in interviewing and diagnostic evaluation (2, 3).

By viewing the playback of his teaching session, each instructor could determine answers to the following questions:

1. Was the content appropriate? Did the instructor have a thorough knowledge of the subject matter? Were the major points sufficiently illustrated?

2. Were the purposes, objectives, and relevancy of the subject thoroughly explained to the students?

3. Was the presentation well organized?

4. Did the instructor speak clearly, maintain eye contact, avoid stereotype behavior, and appear interested and enthusiastic about the subject?

5. Did the instructor encourage student questions, opinions, and comments?

6. Did the instructor use audio-visual aids? Were the aids effective in promoting understanding?

7. Were the main points summarized as they were presented and at the end of the presentation?

8. What were the student reactions to the various points made in the lecture?

The video-tape presented answers to each of these questions for each instructor's consideration. The instructors could review the tape as many times as they wished, and they could make notes on how they could improve sections or revise the content to be more effective. Some instructors had colleagues and an education specialist review the tape and offer comments and suggestions. By using video-tape, these individuals could review the instructor's teaching session as many times as they wished and at their leisure - a situation that would not exist if they had to see the live presentation.

By using a split-screen method, the instructor could simultaneously review what he was saying and doing and what effect he was having on the students. He could determine if he had spoken too rapidly for student note-taking, if the students were attentive, if he allowed time for the students to study the diagrams or illustrations he used, and if the students seemed confused over certain points. After reviewing his tape, the instructor can plan to make the necessary adjustments to improve his lecture.

The video-tapes can be retained for further analysis by the instructor. During his next teaching session, he can make a second tape and compare his teaching with that of the first tape.

Each participant was asked to make note of his feeling concerning the value of the taping before it took place, and later to give his comments concerning the taping session and also his reactions upon viewing the tape.

Some of the comments were as follows:

"After viewing the films some good things came out. I saw for the first time that many students were attentive. ... There were long pauses in my delivery which I think I will retain. The students apparently use these intervals to complete writing what they have heard...."

"I was satisfied with my performance. Other than habitually using several phrases, I thought that the material came across well. All in all, I thought it was a good experience."

"I was surprised at the number of 'slips of the tongue' I made. I can see a great future for such tapes in time saving and ready availability for student review ...."

"I did find my viewing of the recording helpful in determining weaknesses in my delivery. At times, connecting statements between topics were missing. My comments on the slides were particularly disjointed and inept. I also have trouble understanding myself .... I have no objection to having future lectures televised."

"I was quite surprised at the value of the TV tape as a measure of evaluation of teaching, especially for oneself. I recommend it highly as a means of improving lecture delivery, becoming aware of mannerisms that might be coped with, and, when done by a committee as a means of assessing quality of class presentation."

"Prior to participating in this program I indicated that I anticipated some apprehension on my part due to the presence of the TV cameras in the lecture room. However, during the actual taping session I found that this was not the case. I was too busy concentrating on the presentation of the material to worry about the presence of the cameras. Therefore, I feel that the camera equipment, etc. in the lecture room did not alter my presentation. I found a review of this tape extremely helpful in locating sources of error in my presentation and points of possible confusion to the students. This information will be of considerable help in sharpening up lectures for future presentation. In summary, I feel that the taping of lectures is of considerable benefit to the lecturer and I would like to have more of my lectures taped in the future."

As a part of the television project, 25 randomly selected students in the medical physiology class were interviewed in order to get answers to specific questions and to get constructive feedback. It was felt that since the students would be personally interviewed, a random selection would better facilitate the study while allowing inferences to be made for the entire class. Basically, the purpose of the interviews was to obtain answers to the following questions: 1) What do the students think of the video-tape teaching improvement project? 2) Was the video-taping equipment distracting to the students? 3) Do the students feel that all instructors should be video-taped for improvement of teaching?

The interviews revealed that students were very favorable toward the project. They were impressed that the physiology faculty had so much interest in the improvement of teaching; and they felt that in some cases, this procedure was needed. No student indicated that the project was a waste of time.

The video-taping equipment was not distracting to students. Most students stated that after the first few minutes, they forgot that the TV equipment and operators were present. Since the tapes were not made for anything but self-evaluation purposes, no special lighting or microphone systems were used; therefore, there should have been little, if any, distraction. It was comforting to find that students agreed.

Most of the students thought that all instructors should be video-taped for self-evaluation. They felt that most instructors would benefit from seeing themselves as students see them.

Summarily, the video-tape project had a very positive effect on the faculty and students. The participating faculty were able to see how they can improve their teaching and how television can help them become more effective instructors. This initial experience has helped remove many common fears some faculty had concerning seeing and hearing themselves on television for the first time. After determining that they were not so bad after all, they are now willing to continue this project next year. Also, by removing some of this initial anxiety, some of the instructors plan to make production video tapes of lectures over material that is difficult for the students to understand. This procedure will allow a student to have the material presented as many times as he wishes until he has mastered it. The students looked upon this project with appreciation, because they could see that the faculty was sincerely interested in student learning, and this had a positive effect on their attitude toward the faculty and the course.

Television has been used very effectively by college of education in training public school teachers; however, to date, its use in teaching improvement in higher education has been limited to a few individual faculty members. Those volunteering faculty members in this project should be commended for their interest and efforts in the improvement of their teaching.

Analyzing Examinations

It is hoped that information obtained in the Medical Physiology course will be useful to students in their continuing study of medicine. To enhance this process, students are evaluated on the various systems covered in the course, i.e. renal, cardiovascular, etc., as well as their overall performance in the course. Therefore, since the second year Biology of Disease course is broken down into systems, it was felt that it would be particularly worthwhile to the student to know that he needed additional knowledge of a given area. With some review prior to beginning his second year, the student may circumvent some of the problems he may have otherwise encountered. Also, this information would be useful in studying for National Board exams.

The Medical Physiology course is divided into systems (nerve-muscle, cardio-vascular, respiratory, renal, endocrine and G.I.). Each question, multiple choice or discussion, given on the mid-term or final exam was categorized in one of these systems. The computer program used for final evaluation provided the student's overall performance and his percentage of correct answers on each of the various systems.* If a student's performance on any system was one standard deviation below the mean of the class, he was notified of his weakness in that

*Information concerning the computer program used for the analysis of examinations can be obtained from Dr. Frazier or Dr. Holcomb.

TABLE I

Student Name	Mid-term	Final	Total		Nerve Muscle	Respira-tory	G.I.	Endocri-nology	Renal	Cardio-vascular
1. Student X	67.0	87.0	154.0	Multiple-Choice	68	47	90	91	100	71
				Discussion	83	35	90	73	88	77
				Total	74	41	90	82	92	75
2. Student Z	62.0	74.0	136.0	Multiple-Choice	68	35	70	64	100	54
				Discussion	83	44	60	82	75	65
				Total	74	40	65	73	85	60
				Class Mean	70.5	69.7	63.3	66.7	70.7	73.3

Table I provides an example of how this procedure operates. Student X was above the mean of 70.5 on Nerve-Muscle, far below the mean of 69.7 on Respiratory, far above the mean of 63.3 on G.I., above the mean of 66.7 on Endocrinology, above the mean of 70.7 on Renal, and even with the mean of 73.3 on Cardiovascular. Therefore, student X received written notification of his need for additional study of the physiology of the respiratory system. Student Z fell below the mean in respiratory and cardiovascular systems, and he received notification of this weakness.

Both of the student examples used above passed Medical Physiology. In the past, they would have simply been notified of their success in passing the total course, but no indication would have been made of any specific area weakness(es). The method described here enables the examination process to become a learning experience for the student because it enables the student to better direct his continued study of physiology.

system. Since all of the exams contain both multiple choice and discussion questions, the student was also evaluated on his grasp of both factual and conceptual information.

In order to determine the effectiveness of this procedure, the performance of those students who received notification of specified weakness(es) will be compared with a matched group of students from a previous class who were not notified of their need for additional study. This comparison will be on the basis of the groups' performance in the Biology of Disease course and on clinical rotations. There have been some preliminary indications that those students who received notification of weaknesses have reacted in a positive manner in that they have requested special tutorials. Surprisingly, many student comments were concerned with the revelation that perhaps basic information presented in the first year may have some relevance to the second and third years after all.

In addition to evaluating the student, this examination procedure allows for further evaluation of the course. If the mean of the class was very low on any system, an investigation can determine the cause. Was too little time devoted to the system? What was the quality of teaching? Was there something unique about the evaluation of this system? Information was provided for the last two questions through student evaluation of the instructors and through evaluating each question on the examination for its degree of difficulty. The student evaluations of the instructors were very helpful in deciding if a class did poorly because of the level of instruction. If the teaching was satisfactory and the questions were appropriate, the time allotted to this system must be considered. On the basis of the information provided by this evaluation procedure, the Medical Physiology course has undergone some reorganization. Time for two of the blocks has been expanded and there have been some personnel changes.

Contacting Members of Clinical Departments for Feedback

Chairmen and division heads within various clinical departments were contacted to discuss the content of the Medical Physiology course. Particular interest was in how well the physiology course was correlating with what was being required of the students in their second year course Biology of Disease, and, subsequently, on clinical rotations. In general, the feedback was quite good. Several clinicians actively participated in the course, and their input has promoted more clinical correlation. The clinical departments were requested to submit a list of questions concerned with physiological principles which they would expect their students to know. These questions were incorporated into a review and problem session. Since these questions were clinically oriented, they were very helpful in establishing relevance of the basic material being presented. Also, this contact allowed any faculty member who found fault with the teaching of a particular system, the opportunity to make positive suggestions. The most immediate benefit of this experience was the opening of more lines of communication between the basic science and clinical departments.

Summary

The Department of Physiology and Biophysics has engaged in a project designed to improve the overall quality of a course entitled Medical Physiology. In order to maintain clinical relevance, clinicians were used in the teaching of various systems. Also, many clinicians were contacted concerning the content of the course. The most immediate benefit of this experience was the opening of more lines of communication between the basic science and clinical departments. In order to improve teaching and learning, eight faculty members were video-tape recorded for self-evaluation. This procedure improved teaching, improved student attitudes toward the faculty, and opened the way for continued effort toward teaching effectiveness. It is hoped that student learning has been advanced through a strength and weakness feedback system. Students should be able to direct their continued study of physiology more effectively, and the faculty can determine causes of student failure. This evaluation has been a very worthwhile experience. It will be continued and expanded during the 1971-1972 academic year.

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STATISTICS ON APS REGULAR MEMBERS

(as of December, 1971)

Distribution by Degrees

Ph. D.	1638	46.44%
M. D.	1357	38.47%
Ph. D. & M. D.	414	11.73%
D. Sc.	24	0.68%
Ph. D. & D.V. M.	48	1.36%
Ph. D. & D. D. S.	13	0.37%
Other Doctorates	13	0.37%
No Doctorate	20	0.56%

60% of members hold Ph. D. degree
50% of members hold M. D. degree
1.5% of members hold neither Ph. D. or M. D.

Note: For other statistics of earlier years see PHYSIOLOGIST, Vol. 11, Page 24, 1968.

Distribution by Employment

Medical Schools		60%
Physiology Dept.	898	25.48%
Other Preclinical Depts.	358	10.15%
Clinical	815	22.85%
Administration	51	1.44%
Hospitals and Clinics	170	4.82%
Veterinary Schools	78	2.21%
Dental Schools	28	0.79%
Public Health & Grad. Schools	25	0.70%
Undergraduate Schools	374	10.61%
Commercial Companies	104	2.95%
Government (inc. V.A.)	315	8.93%
Institutes and Foundations	198	5.61%
Private Practice	47	1.33%
Emeritus or Inactive	74	2.10%

INTERNATIONAL SYMPOSIUM ON DYNAMICS AND CONTROL IN PHYSIOLOGICAL SYSTEMS

This International Symposium is to be held at the University of Rochester, N.Y., August 22-24, 1973 just prior to the annual 1973 APS meeting at McGill University, Montreal, Canada. It is co-sponsored by the International Union of Physiological Sciences, the American Physiological Society, the American Society of Mechanical Engineers, and the International Federation of Automatic Control.

The objective of the Symposium is to encourage important summaries of the major physiological control systems in complex living systems by joint efforts of biologists and engineers - in particular to encourage joint crossed disciplinary efforts from different institutions.

Suggested topic areas are: - Biochemical control at the membrane level; Dynamic modes of drug action; Organ regulation and control; Overall systems response (metabolism, thermoregulation, electrolyte regulation, behavioral regulation, nervous control); Homeostatic regulation.

Interested authors of either discipline (physiology or engineering) may write to either of the program chairmen (see below) indicating by brief outline, specific interest, proposed partnership for the paper, or partnership desired. The program chairmen will try to match the author's interest with a potential coauthor from the other discipline. Results desired ultimately are joint papers that agree, or disagree, but at least illuminate the problem areas by their differing points of view. About one third of the papers will be invited overviews. Interested authors should write one of the program chairmen. Interested attendees should write to the general chairman.

General Chairman: Prof. G. Cohen, Univ. of Rochester, Rochester, N.Y.

Program Chairmen: Prof. L. Carlson, Sch. of Medicine, Univ. of California, Davis, Calif.

A. Iberall, General Technical Services, Inc., 8794 West Chester Pike, Upper Darby, Pa.

NEWS FROM SENIOR PHYSIOLOGISTS

The following letters and notes were received by members of the APS Senior Physiologists Committee after sending birthday greetings.

A. V. Hill writes from Cambridge, England:

"Thank you for your kind greetings for my birthday. Do you, or does the Society, keep a computer to remind you of such events? I have no news except that the Cambridge Press tells me that there is a Russian edition of my book, 'First and Last Experiments in Muscle Mechanics.' Perhaps after the current sending home of Russian spies the translation of my book will be banned. I see Adrian now and then. He telephoned me this morning after returning from Rio. In 1953 I planted a tree in the Jardin Botanico there. They originally put a plaque on it attributing its planting to someone who died in 1941. The plaque has disappeared but Adrian went to the office where they keep a book listing all tree plantings. He found in the book the planting of a tree in 1953 by someone I knew well who died in 1941. The only other thing I ever planted was some mustard and cress in 1896."

Mrs. Thorne Carpenter writes:

"Thorne passed away on January 27, 1971. He was 93 years old. He was only ill about two weeks. Thank you very much for remembering him."

Gustav Eckstein writes:

"It lit a candle to get your note for my birthday. A bright and lively candle because of several memories. I guess that one thing I have missed along the way has been those trials and tribulations of the administrator, that you speak of, but of course have had the customary human share, I suppose, to kick me along. Yes, since you asked, all is going well. Am working on a book on Pavlov, far into it, liking to do it. He does something for me every day."

Paul E. Howe writes:

"It was very pleasant and friendly to have a letter from you on my birthday. For years I have visited New Orleans when a Nutrition Consultant to the Bureau of Prisons, Dept. of Justice.

"Perhaps I should explain my status. I was originally appointed Nutrition Consultant to the Bureau of Prisons soon after I graduated in physiological chemistry under Prof. P. B. Hawk at the University of Illinois. Followed by an assistant professor of biological chemistry at Columbia University Medical School when at 59th St., New York, N.Y.,

and I became involved with the USDA later, 1925.

"Previous to World War II I was asked to review the nutritional adequacy of the rations of the US Army, and found them adequate. Later when in the service in Italy I was standing on a hill with a Colonel and noticed the Colonel's aide had the typical bleeding gums of franck scurvey. I immediately cabled the SGO from Gen. Bellese's office in Algiers the need to require the addition of Vitamin C to some canned food to which Vitamin C was present. From that time on when reviewing the nutritional adequacy of messes I always enquired whether the soldiers in the mess had received lemonade made from the C and K rations; which sometimes was made when troops were fed from these rations as a group. That was always a difficult procedure because all food had to be opened. Lt. Col. Griffith had come down to see how things were going in Italy and we agreed it was necessary. (A long tale but the most interesting of my experience.)

"I should explain my visits to New Orleans. The City jail at that time was a prison just East of the Center of the City (East of the open area perpendicular to the water, and lined by, at my time apartment houses.) You can see I remember the city well though it may have changed considerably. I do not know whether or not the jail is still there but it is definitely part of the picture. Obviously I became lost in trying to identify the jail, and offer my apologies if I over-did the City and jail."

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NEWS FROM HONORARY MEMBERS OF THE SOCIETY

Copies of the print of Beaumont House from the drawing by DeWitt Whistler Jayne were sent recently to all of the Honorary Members of the Society as a token of friendship and respect for our very distinguished colleagues in other countries. Notes of appreciation have now been received from many of them, including the following:

Sir John C. Eccles, now at the University of Buffalo;

Professor Ragnar Granit of Stockholm, at the Fogarty International Center of NIH in Bethesda until April 15, 1972;

Lord Adrian of Trinity College, Cambridge;

Professor A. V. Hill, also of Cambridge;

Professor A. L. Hodgkin, Physiological Laboratory in Cambridge;

Professor W. R. Hess, writing from Ascona, Switzerland;

Dr. Alberto Hurtado, Instituto de Investigaciones de la Altura in Lima, Peru;

Professor E. Gutmann, Institute of Physiology of the Czechoslovak Academy of Sciences in Praha;

Professor Genichi Kato, Tokyo, Chairman of the J. N. P. S. ;

Professor Giuseppe Moruzzi, Instituto de Fisiologia, Pisa;

Professor Hans H. Weber, Institut für Physiology, Heidelberg;

Professor Hess, who is past his ninetieth birthday, wrote that he regrets that he cannot look forward to a third visit to the United States. Professor Hill remarked that it was Wallace Fenn who informed him that he had been elected as an Honorary Member during the presidency of Dr. Fenn. Professor Hill's letter continues: "I had the pleasure of replying that this was a unique honour since I had also been elected about four years before. Rather like a bar to a Victoria Cross! I asked him if he could arrange for me to be elected a third time, but he did not think that would be easy."

Several of the Honorary Members wrote that the print will remind them of pleasant visits to Bethesda, as well as of the Washington Congress in 1968 and of Wallace Fenn, the President of the International Union.

REGIONAL MEETING OF IUPS

A regional meeting of the International Union of Physiological Sciences will be held in Sydney, Australia, from 21 to 25 August, 1972. The meeting will be sponsored by the Australian Academy of Science in collaboration with the Australian Physiological and Pharmacological Society.

The general scientific theme of the meeting will be Physiological Communication and Control Systems. There will be two Special Lectures by distinguished speakers; sessions of Free Communications; ten Symposia (see below); exhibits; demonstrations; films; visits to laboratories; banquet, and ; excursions.

Symposia include: The role of physiology in the teaching of medicine; Evolution of pulmonary function in vertebrates; Hierarchial control of biological systems; Neural control of the circulation; Micropuncture studies on renal tubular function; Physiological responses to a hot environment; Trophic interactions of excitable cells; Control of parturition; Pancreatic hormones; Peripheral receptor mechanisms; Transmission between excitable cells.

The meeting is unrestricted and applications to contribute papers and/or to attend should be sent to the Chairman of the Organizing Committee, Professor W. Burke, Dept. of Physiology, Univ. of Sydney, Sydney, NSW, Australia, 2006. Further information can be obtained from the Executive Secretary, Australian Academy of Science, P.O. Box 216, Civic Square, ACT, Australia, 2608.

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SEVENTH NATIONAL CANCER CONFERENCE

The Seventh National Cancer Conference will be held September 27-29, 1972 at the Biltmore Hotel in Los Angeles. It is sponsored by the American Cancer Society and the National Cancer Institute. All members of the medical and related professions, research investigators and medical and dental students are invited to attend. There is no registration fee but preregistration is requested.

For further information write: Sidney L. Arje, M.D., Coordinator, c/o American Cancer Society, 219 East 42nd Street, New York, N.Y., 10017.

SIR JOSEPH BARCROFT CENTENARY SYMPOSIUM ON FETAL AND NEONATAL PHYSIOLOGY

A Symposium will be held by the British Physiological Society in Cambridge, England on July 24-28, 1972 to commemorate the centenary of the birth of Sir Joseph Barcroft. The program will contain communications from invited speakers together with free communications. Sessions will include discussion periods covering Endocrinology, Metabolism, Respiration, Circulation, Placenta, the Nervous System and Parturition. Participation will be limited to 250 active members of the Symposium.

A Commemoration Dinner will be held in King's College, Cambridge on July 26, 1972.

Further information may be obtained from Dr. P. W. Nathanielsz, The Sir Joseph Barcroft Centenary Symposium, Physiological Laboratory, Cambridge, England. Requests for information should be accompanied by an indication of any intent to present a free communication reporting novel work, together with a provisional title.

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STUDENT RATES FOR PHYSIOLOGICAL REVIEWS

The American Physiological Society is offering Physiological Reviews to students at the reduced rate of $10 per year. Students are defined as those registered for credit toward a degree as well as those holding official appointments as interns, residents or post-doctoral fellows in North America. Certification and validity of student status, as defined above, will be attested to by the inclusion of the signature of a regular member of the Society on the subscription order. Certification also will be necessary for renewals of student subscription orders.

The reduced student rate does not apply to the other Society journals.

PHYSIOLOGICAL CONTROL CIRCUITS

CECIL ALLWEIS, Ph. D.
Department of Physiology
Hebrew University-Hadassah Medical School
Jerusalem, Israel

Under the sponsorship of the United States National Library of Medicine, Dr. Cecil Allweis has written a critical review of diagrammatic representations of physiological control mechanisms. He points out the lack of uniformity in such diagrams and in his review he proposes a uniform convention based upon cybernetic principles. At the meeting of the American Physiological Society in Kansas City last August, Dr. Allweis gave a special lecture on this subject. The full work is entitled "Diagrammatic Representations of Physiological Control Mechanisms" and is available from the National Technical Information Service for three dollars per copy. Requests should be directed to:

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22151

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VISITING FOREIGN SCHOLARS

The Committee on International Exchange of Persons has recently issued a Directory of Visiting Lecturers and Research Scholars in the United States who have been awarded grants under the Fulbright-Hays Act for 1971-72. Many of these scholars would be pleased to accept invitations to give lectures or to participate in special conferences sponsored by academic institutions and educational organizations during their stay in the United States.

Persons interested in receiving a copy of the Directory for the academic year 1971-72 or wishing general information regarding the Fulbright-Hays exchange program for visiting scholars from abroad are invited to write to the Committee on International Exchange of Persons, 2101 Constitution Avenue, N.W., Washington, D.C. 20418 (or telephone 202-961-1647).