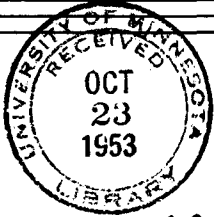


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Bulletin of the
University of Minnesota Hospitals
and
Minnesota Medical Foundation



Effects of Fever
and Hypoxia

BULLETIN OF THE
UNIVERSITY OF MINNESOTA HOSPITALS
and
MINNESOTA MEDICAL FOUNDATION

Volume XXV

Friday, October 23, 1953

Number 3

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I. OBSERVATIONS ON THE EFFECTS OF FEVER AND HYPOXIA IN DOGS AND MONKEYS

William G. Kubicek, Ph.D.
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INTRODUCTION

Investigations concerning the role of oxygen in the metabolic processes have been carried out throughout the history of medicine. Lavoisier¹ in 1780 was the first to recognize the correlation between animal heat and oxidation within the body. The studies of Lusk² (1928) were a great contribution to the understanding of oxygen utilization in living systems. During the past two decades, commercial and military aviation have stimulated inquiry into the effects of low oxygen tensions in the inspired air upon normal humans and animals in an environment cooler than body temperature.³ Some research has been directed at the results of fever alone. The question of the effect of hypoxia combined with fever has attracted the attention of only a few investigators.⁴

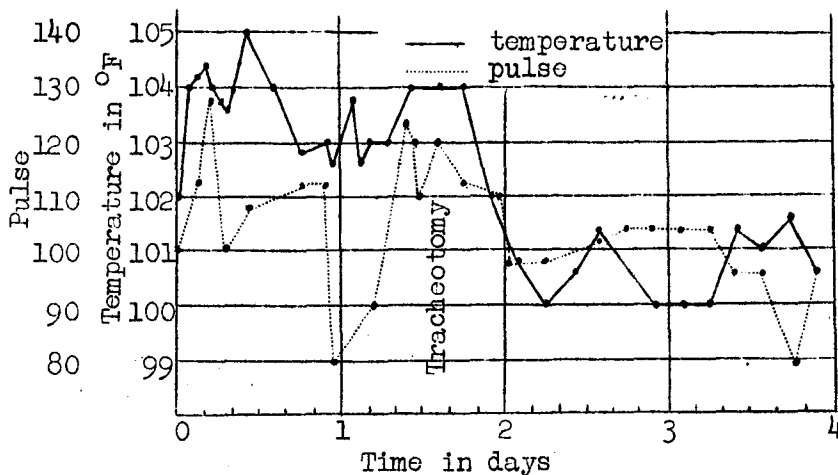
Clinically, the possibility of disturbances in the delivery of oxygen into

the blood stream occurs frequently. Pulmonary edema or atelectasis may impair diffusion of oxygen across the alveolar membranes. In poliomyelitis, airway obstruction or paralysis of the respiratory muscles often results in a reduced alveolar pO_2 . Other diseases reduce the efficiency of the blood oxygen transport mechanism. The physician is frequently faced with these difficulties combined with an elevated body temperature. During hot weather the problem of hypoxia in the hospitalized patient leads to the question of the possibility of an impaired temperature control mechanism and subsequent production of fever. It has been shown conclusively that hypoxia in the normal human or animal in a cool environment will produce a decrease in body temperature. In contrast to these findings, observations of body temperature and pulse rate in bulbar poliomyelitis patients with a fever combined with hypoxia indicated the possibility that fever may be aggravated by hypoxia. One case is presented here as an example. (Figure 1.)

A seventeen year old white male () with severe bulbar involvement upon admission to the University Hospitals maintained a body temperature of approximately $104^{\circ}C$. and an average pulse rate of

FIGURE 1

A record of the temperature and pulse rate of a patient with bulbar poliomyelitis before and after tracheotomy.



110 for over 36 hours in spite of antibiotics and other therapy. Obvious cyanosis was present throughout this period. At the end of the thirty-six hour period, a tracheotomy was performed. A warm humidified gas mixture of 50% oxygen and 50% helium was administered via the tracheotomy tube. In twelve hours following tracheotomy, the temperature decreased from 104°F. to 100.5°F. and the pulse dropped from 120 to 100 per minute.

Purpose

The specific goal of this investigation was to attempt to elucidate the question of whether or not fever could be aggravated by hypoxia. In addition, data were obtained in regard to circulation, metabolism, and gross and microscopic tissue studies.

Methods

Dogs or monkeys sedated with Nembutal and Demerol were used as the experimental animals. Fever was produced in dogs by enclosing the head in a hood and allowing the animal to breath warmed humidified mixtures of oxygen and nitrogen. Fever was induced in monkeys either by diathermy or radiant heat. Observations were made of oxygen partial pressure of the inspired gas, rectal temperature, oxygen consumption, blood pressure, pulse rate, hematocrit, blood sugar, and plasma creatinine. Gross and microscopic studies were performed on the brain and visceral organs.

Results

The data shown in Figure 2 were obtained during an experiment with fever first established in a dog breathing air. At a body temperature of approximately 43°C., the pO₂ of the inspired gas mixture was reduced to 48 mm. of mercury. An abrupt fall in rectal temperature occurred within fifteen minutes after the beginning of hypoxia. This was accompanied by a rise in hematocrit and a fall in oxygen consumption. During hypoxia, systolic blood pressure increased and diastolic pressure decreased. The primary point of interest in this experiment

was the maintenance of an adequate blood pressure throughout the experiment. In general, the condition of the circulatory system in this animal was fairly good at all times. In this case, hypoxia produced a fall in body temperature during the fever.

The data in Figure 3 illustrate a case where fever was aggravated by hypoxia in a dog. After a fever of approximately 42.5°C. was established, the pO₂ of the inspired air was reduced to 48 mm. Hg. A sharp increase in body temperature occurred within twenty minutes after the start of hypoxia. It was necessary to reduce the body temperature rapidly with fans in order to save the animal. The distinguishing feature of this experiment is the shock-like state of the animal which developed during the hypoxic period. In this experiment, the general condition of the circulatory system was estimated as poor. In this case, fever was aggravated by hypoxia.

A variety of central nervous system disturbances were noted in these animals. For two to six hours following return to normal temperature, convulsions, alternate periods of CNS hyperexcitability and depression were noted in the more severe cases. Generalized incoordination was a common finding. An interesting feature of these CNS disorders was that upon recovery, the fore limbs usually recovered before the hind quarters.

Fever usually depressed the blood sugar level, in some instances to extremely low levels. Hematocrit and plasma creatinine were elevated in nearly all cases. At the termination of these experiments, the animals were sacrificed at various lengths of time after exposure to these conditions. In a series of acute experiments, the animals were sacrificed at the end of the experiment. In a series of chronic experiments, the animals were sacrificed two to three weeks later in order to allow time for possible neuron degeneration. The animals were perfused with formalin through the left ventricle immediately following death. Capillary hemorrhage and various cellular disturbances were observed in the heart, kidneys, intestine and liver. (Fig. 4.)

FIGURE 2

Blood pressure, oxygen consumption, hematocrit and rectal temperature during fever and hypoxia in a dog.

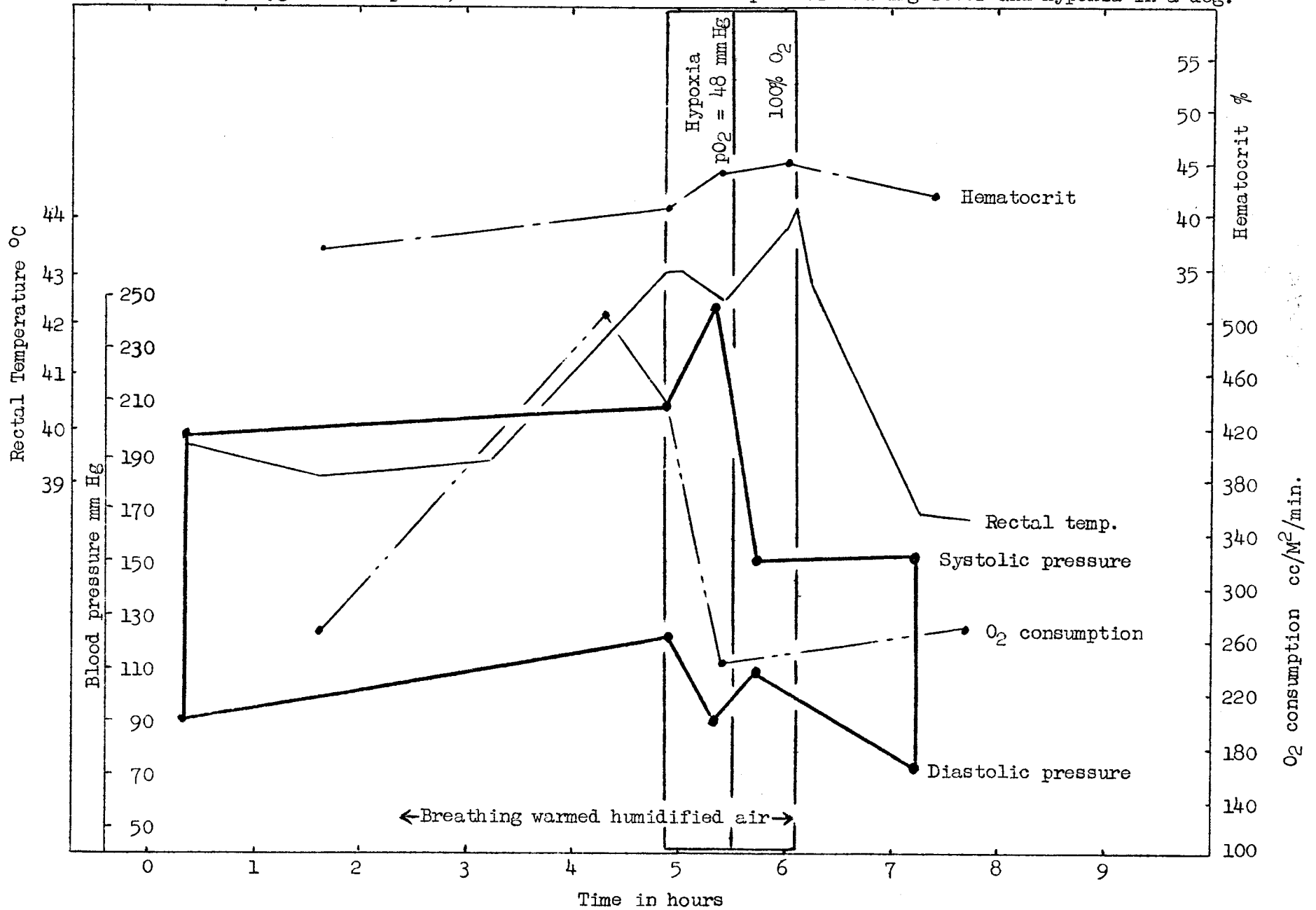
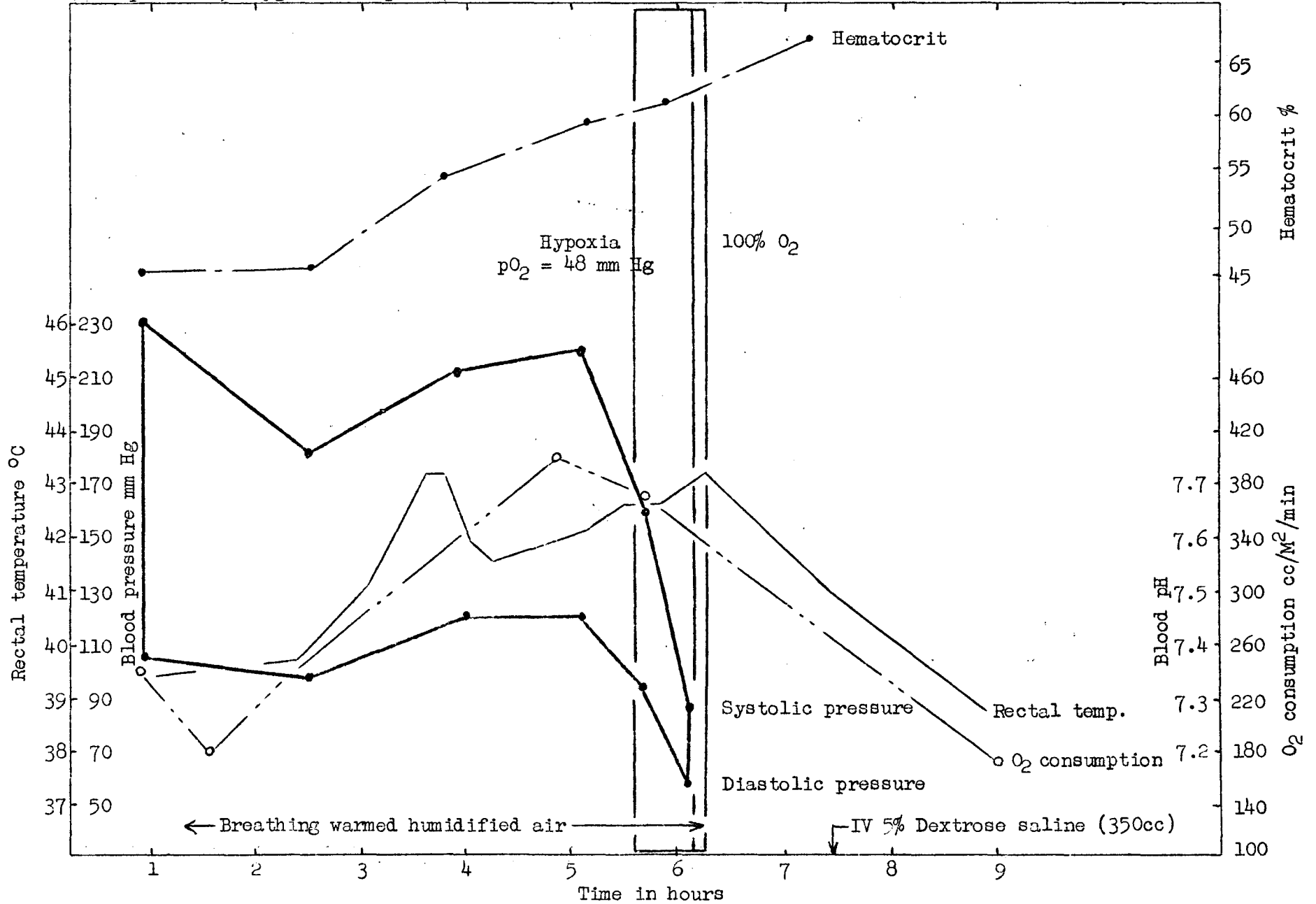


FIGURE 3

Blood pressure, oxygen consumption, hematocrit and rectal temperature during fever and hypoxia in a dog.



Heart	Kidney	Intestine	Liver	Brain
++++	+++	++	+	—

Figure 4. The degree and frequency of degenerative tissue changes found in dogs and monkeys after acute exposure to fever and hypoxia. Range ++++ Extensive tissue damage in nearly all case to — no conclusive tissue changes.

No lesions were observed in the skeletal muscle or the brain. Sections were made of the cortex, hypothalamus, brain stem and spinal cord. Brains obtained from animals which had not been perfused with formalin showed postmortem autolysis within one hour following death of the animal. No tissue changes outside the normal variations were observed in any of the brains from dogs or monkeys subjected to severe fever and hypoxia.

COMMENT

The main conclusion from these data has been that under certain physiological conditions hypoxia can contribute to a hyperpyrexia state. The observations on the relief of fever following adequate oxygenation in poliomyelitis victims indicated the probability of hypoxia as a contributing factor in the fever. It is recognized that the animal experiments presented here were not complicated by a disease process and that some reservations should be made in applying information obtained from laboratory animals to clinical practice. The fundamental physiological aspect of these data indicates that if the circulatory system is unable to remove heat from the visceral organs during hypoxia an elevation in body temperature may occur. On the other hand, if the circulatory system is in good condition to remove heat from the system, hypoxia will result in a decreased fever in accordance with the results of other workers using normal humans and animals in a cool environment. These data also indicate that clinical conditions associated with a depressed circulatory system may warrant prophylactic oxygen therapy. The patient undergoing surgery is frequently subjected to

high environmental temperatures, impaired respiration, and blood loss. Cullen and Skewis⁷ and others have reported the desirability of prophylactic oxygen therapy in surgical patients. In general, hypoxia should be avoided if at all possible in any case where fever is either present or imminent.

The results of the histological tissue studies reported here agree with the reports of other investigators, except in the case of the brain sections. Hartman,^{6,7} and others have reported tissue damage by fever in most of the visceral organs and the brain⁸. The main difference in the results reported here was apparently due to the perfusion of the animal with formalin immediately after death⁹. Due to the difficulty in removing the brain, postmortem autolysis probably accounts for some of the reports of hypoxic damage to nerve cells. It should be pointed out, however, that in spite of the lack of detectable nerve cell damage by the methods currently available, function of the individual nerve cells or nuclei may be impaired or abolished by the conditions of these experiments. Impairment of mental and motor functions is accepted as an early sign of hypoxia in the normal individual; therefore, the lack of demonstrable nerve cell damage in these experiments should not detract from the attention to insuring adequate oxygenation of the clinical patient.

SUMMARY

1. Clinical observations on bulbar poliomyelitis patients with fever indicated the desirability for experimental work directed at the problem of inadequate oxygenation in the hyperpyrexia patient.

- II. Experiments upon dogs and monkeys revealed that hypoxia may aggravate fever especially when the circulatory system is in poor condition.
- III. Histological tissue studies in these experiments confirm the work of other investigators of demonstrable tissue damage in the visceral organs. The results of microscopic brain tissue studies failed to show conclusive histological changes in spite of severe neurological disturbances during the course of the experiments.
- IV. The reduced blood sugar and elevated plasma creatinine noted in these experiments indicates the possibility of serious metabolic impairment during hyperpyrexia.

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II. MEDICAL SCHOOL NEWS

Coming Events

- October 26 Seminar on History of Medicine; "Richard Bright and His Contributions to Renal Disease"; Dr. Norman M. Keith, Professor Emeritus, Department of Internal Medicine, Mayo Foundation, Rochester; Todd Amphitheater, University Hospitals; 7:15 p.m.
- October 26-31 Continuation Course in Radiation Therapy for Specialists.
- October 28 Leo G. Rigler Lecture; "Simple Mastectomy and Postoperative Irradiation for Carcinoma of the Breast"; Dr. Robert McWhirter, Professor of Radiotherapy, Royal Infirmary, Edinburgh; Museum of Natural History Auditorium; 8:15 p.m.
- November 3 Elias P. Lyon Lecture; "Action of Sex Hormones on Experimental Diabetes"; Dr. Bernard A. Houssay, Argentina; Owre Amphitheater; 8:00 p.m.
- November 5-6 Continuation Course in Medical Jurisprudence
- November 6-7 Homecoming Program
- November 16-18 Continuation Course in Fractures for General Physicians
- November 19-21 Continuation Course in Dermatology for General Physicians

* * *

Continuation Courses

The University of Minnesota announces a continuation course in Radiation Therapy for Specialists which will be held at the Museum of Natural History Auditorium and the Center for Continuation Study on the University campus from October 26 to 31, 1953. Principles and clinical applications of all forms of irradiation therapy will be discussed. The guest faculty will include Dr. Robert McWhirter, Professor, Department of Radiotherapy, Royal Infirmary, Edinburgh; Dr. Raymond E. Zirkle, Institute of Radiobiology and Biophysics, University of Chicago; Dr. Edith H. Quimby, Associate Professor, Department of Radiology, College of Physicians and Surgeons, Columbia University, New York City; and Dr. Lauren V. Ackerman, Professor of Surgical Pathology and Pathology, Washington University School of Medicine, St. Louis. Dr. McWhirter will also deliver the annual Leo G. Rigler Lecture on Wednesday, October 28. The course will be presented under the direction of Doctors Leo G. Rigler, Professor and Head, Department of Radiology, and K. W. Stenstrom, Director of Radiation Therapy. Members of the faculty of the University of Minnesota Medical School and the Mayo Foundation will complete the faculty for the course.

A continuation course in Medical Jurisprudence for Physicians will be presented by the University of Minnesota November 5 and 6 at the Center for Continuation Study. This program has been designed to meet the needs of the physician who wishes to improve his understanding of certain legal aspects of medical practice. Guest speaker for the course will be Dr. Francis J. Gerty, Professor and Head, Department of Psychiatry, University of Illinois College of Medicine, Chicago, and the remainder of the faculty will include members of the faculty of the University of Minnesota. This course will be presented as one of a series of Homecoming Week events which will be of interest to all physicians.

* * *

Medical School to Provide Hennepin County Medical Society Program

The Medical School will provide the scientific program for the meeting of the Hennepin County Medical Society on Monday, November 2. The presentation entitled,

"When Patients Should Keep Their Neuroses" will be given by Doctors Donald W. Hastings, Frank Kiesler, Burtrum C. Schiele, C. K. Aldrich, and Clarence Rowe. Members of the faculty, residents, and interns are urged to attend this program.

* * *

Faculty News

Dr. Donald W. Cowan, Associate Professor, School of Public Health, and Assistant Director, Students' Health Service, has recently returned from Europe where he spent six weeks at Queens University, Belfast, Ireland, in exchange with Dr. Wilson Johnston who observed methods here at the University of Minnesota. Dr. Cowan also attended a meeting of the British Student Health Officers Association in Glasgow, Scotland, where he presented a paper on "Colds -- Prevention and Treatment." Dr. Cowan also toured the European continent.

Dr. Lawrence R. Boies, Professor and Head, Department of Ophthalmology and Otolaryngology, and Director, Division of Otolaryngology, has been elected to the Board of Secretaries of the American Academy of Ophthalmology and Otolaryngology at the annual meeting in Chicago which was held from October 11 to 18.

Dr. James Rogers Fox, Instructor, School of Public Health, and Physician, Students' Health Service, who is a member of the Television Panel of the American Medical Association Public Relations, addressed the group recently in Chicago. He also presented two papers entitled, "Health Unit in Rochester" and "Health Education" at the Minnesota Public Health Conference which was held last week in Minneapolis. He also has been elected Treasurer of the newly formed Minnesota Academy of Occupational Medicine.

Participants in the program for the Industrial Health Conference held in Minneapolis recently included Doctors Donald W. Hastings, James Rogers Fox, Malcolm A. McCannel, Albert T. Hays, and Wilford Park. Dr. Park discussed the role of the physician in industrial medicine.

* * *

III.

UNIVERSITY OF MINNESOTA MEDICAL SCHOOL
WEEKLY CALENDAR OF EVENTS

Physicians Welcome

October 26 - 31, 1953

Monday, October 26

Medical School and University Hospitals

- 9:00 - 9:50 Roentgenology-Medicine Conference; L. G. Rigler, C. J. Watson and Staff; Todd Amphitheater, U. H.
- 9:00 - 10:50 Obstetrics and Gynecology Conference; J. L. McKelvey and Staff; W-612, U. H.
- 10:00 - 12:00 Neurology Rounds; A. B. Baker and Staff; Station 50, U. H.
- 11:30 - Tumor Conference; Doctors Kremen, Moore, and Stenstrom; Todd Amphitheater, U. H.
- 11:30 - 12:30 Physical Medicine Seminar; Electromyography in Peripheral Nerve Injuries; R. S. Blanchard; Heart Hospital Auditorium.
- 12:15 - Obstetrics and Gynecology Journal Club; Staff Dining Room, U. H.
- 12:30 - 1:30 Physiology Seminar 201; Measurement of Total Metabolism by Means of Doubly Labeled Water; Nathan Lifson; 214 Millard Hall.
- 1:30 - 2:30 Pediatric-Neurological Rounds; R. Jensen, A. B. Baker and Staff; U. H.
- 3:30 - Public Health Seminar; Changing Health Problems in the Western World; Ancel Keys; 15 Owre Hall.
- 4:30 - ECG Reading Conference; James C. Dahl, et al; Staff Room, Heart Hospital.
- 4:30 - Public Health Seminar; 15 Owre Hall.
- 5:00 - 6:00 Urology-Roentgenology Conference; C. D. Creevy, O. J. Baggenstoss, and Staff; Eustis Amphitheater.
- * 7:15 p.m. Seminar on History of Medicine; "Richard Bright and His Contributions to Renal Disease"; Dr. Norman M. Keith, Professor Emeritus, Department of Internal Medicine, Mayo Foundation, Rochester; Todd Amphitheater, U. H.

Ancker Hospital

- 8:30 - 10:00 Tuberculosis and Chest Conference; Auditorium.
- 2:00 - 3:00 Surgery Journal Club; Classroom.

Minneapolis General Hospital

- 9:30 - Pediatric Rounds; Eldon Berglund; Newborn Nursery, Station C.
- 10:30 - 12:00 Tuberculosis and Contagion Rounds; Thomas Lowry; Station M.
- 11:00 - Orthopedic and Fracture Rounds; Drs. John Moe and Arthur Zierold; Sta. A.
- 11:00 - Pediatric Rounds; Erling Platou; Station K.

Monday, October 26 (Cont.)

Minneapolis General Hospital (Cont.)

- 12:30 - Surgery Grand Rounds; Dr. Zierold; Sta. A.
- 1:00 - X-ray Conference; Classroom, 4th Floor.
- 2:00 - Pediatric Rounds; Robert A. Ulstrom; Stations I and J.

Veterans Administration Hospital

- 1:30 - Cardiac Conference; Drs. Berman, Weisbart, and Smith; Rounds immediately following conference.

Tuesday, October 27

Medical School and University Hospitals

- 9:00 - 9:50 Roentgenology-Pediatric Conference; L. G. Rigler, I. McQuarrie and Staff; Eustis Amphitheater, U. H.
- 9:00 - 12:00 Cardiovascular Rounds; Station 30, U. H.
- 12:30 - 1:30 Physiology 114C -- Respiration; E. B. Brown; 129 Millard Hall.
- 12:30 - 1:20 Pathology Conference; Autopsies; J. R. Dawson and Staff; 102 I. A.
- 3:30 - Pediatric Seminar; Investigations of a Family Outbreak of Histoplasmosis; Richard T. Smith; Sixth Floor, U. H.
- 4:00 - 5:00 Pediatric Rounds on Wards; I. McQuarrie and Staff; U. H.
- 4:30 - 5:30 Clinical-Medical-Pathological Conference; Todd Amphitheater, U. H.
- 4:30 - ECG Reading Conference; James C. Dahl, et al; Staff Room, Heart Hospital.

Ancker Hospital

- 8:00 - 9:00 Fracture Conference; Auditorium.
- 9:00 - 10:00 Medical X-ray Conference; Auditorium.

Minneapolis General Hospital

- 9:30 - 10:30 Obstetrics and Gynecology Staff Rounds; William P. Sadler and Staff; 301 Harrington Hall.
- 10:00 - Pediatric Rounds; Spencer F. Brown; Stations I and J.
- 10:00 - Cardiac Rounds; Paul F. Dwan; Classroom, Station I.
- 10:30 - 12:00 Medicine Rounds; Thomas Lowry and Staff; Station F.
- 12:30 - Grand Rounds; Fractures; Willard White, et al; Sta. A.
- 12:30 - Neuroroentgenology Conference; O. Lipschultz, J. C. Michael and Staff.
- 12:30 - EKG Conference; Boyd Thomes and Staff; 302 Harrington Hall.
- 1:00 - Tumor Clinic; Drs. Eder, Cal, and Lipschultz.
- 1:00 - Neurology Grand Rounds; J. C. Michael and Staff.

Tuesday, October 27 (Cont.)

Veterans Administration Hospital

- 7:30 - Anesthesiology Conference; Conference Room, Bldg. I.
8:30 - Surgery Staff Seminar; Medical Conference Room, Bldg. I.
9:30 - Infectious Disease Rounds; Drs. Hall, Zinneman and Brown.
9:30 - Surgery-Pathology Conference; Conference Room, Bldg. I.
10:30 - Surgery-Tumor Conference; L. J. Hay and J. Jorgens; Conference Room, Bldg. I.
1:00 - Review of Pathology, Pulmonary Tuberculosis; Conference Room, Bldg. I.
1:30 - Combined Medical-Surgical Chest Conference; Conference Room, Bldg. I.
2:00 - 2:50 Dermatology and Syphilology Conference; H. E. Michelson and Staff; Bldg. III.

Wednesday, October 28

Medical School and University Hospitals

- 8:00 - 9:00 Roentgenology Surgical-Pathological Conference; Paul Lober and L. G. Rigler; Todd Amphitheater, U. H.
11:00 - 12:00 Pathology-Medicine-Surgery Conference; Pediatrics Case; O. H. Wangenstein, C. J. Watson, and Staffs; Todd Amphitheater, U. H.
12:30 - 1:30 Physiology 114B - Transport Seminar; Nathan Lifson and M. B. Visscher, 214 Millard Hall.
4:30 - ECG Reading Conference; James C. Dahl, et al; Staff Room, Heart Hospital.
5:00 - 5:50 Urology-Pathological Conference; C. D. Creevy and Staff; Eustis Amphitheater.
8:00 - 10:00 Dermatological-Pathology Conference; Review of Histopathology Section; R. Goltz; Todd Amphitheater, U. H.
* 8:15 p.m. Leo G. Rigler Lecture; "Simple Mastectomy and Postoperative Irradiation for Carcinoma of the Breast"; Dr. Robert McWhirter, Professor of Radiotherapy, Royal Infirmary, Edinburgh; Museum of Natural History Auditorium.

Ancker Hospital

- 8:30 - 9:30 Clinico-Pathological Conference; Auditorium.
12:30 - 1:30 Medical Journal Club; Library.

Minneapolis General Hospital

- 8:30 - 9:30 Obstetrical and Gynecological Grand Rounds; William P. Sadler and Staff; Station C.
9:30 - Pediatric Rounds; Max Seham; Stations I and J.
10:30 - 12:00 Medicine Rounds; Thomas Lowry and Staff; Station D.

Wednesday, October 28 (Cont.)

Minneapolis General Hospital (Cont.)

- 11:00 - Pediatric Seminar; Arnold Anderson; Classroom, Station I.
- 11:00 - Pediatric Rounds; Erling S. Platou; Station K.
- 12:15 - Pediatric Staff Meeting; Classroom, Station I.
- 1:30 - Visiting Pediatric Staff Case Presentation; Station I, Classroom.
- 2:00 - 4:00 Infectious Disease Rounds; Sta. D.
- 4:00 - 5:00 Infectious Disease Conference; Wesley W. Spink; Classroom.

Veterans Administration Hospital

- 8:30 - 10:00 Orthopedic X-ray Conference; E. T. Evans and Staff; Conference Room; Bldg. I.
- 8:30 - 12:00 Neurology Rehabilitation and Case Conference; A. B. Baker.
- 9:00 - Gastro-Intestinal Rounds; Drs. Wilson, Zieve, Hay, Brakel and Nesbitt.
- 12:30 - X-ray Conference; J. Jorgens; Conference Room, Bldg. I.
- 4:00 - Combined Medical Surgical Conference; Drs. Flink and Hay; Conference Room, Bldg. I.
- 5:00 - Medical Journal Club; Conference Room, Bldg. I.
- 7:00 p.m. Lectures in Basic Science of Orthopedics; Conference Room, Bldg. I.

Thursday, October 29

Medical School and University Hospitals

- 9:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.
- 11:00 - 12:00 Cancer Clinic; K. Stenstrom and A. Kremen; Todd Amphitheater, U. H.
- 12:00 - 1:00 Medical Journal Club; Artificial Plasma Expanders; Charles M. McCarthy; Heart Hospital Theater.
- 12:30 - Physiological Chemistry Seminar; Acetocholine Esterase in Nerve Function; Wendell Engelstad; 214 Millard Hall.
- 1:30 - 4:00 Cardiology X-ray Conference; Heart Hospital Theatre.
- 4:00 - 5:00 Physiology-Surgery Conference; Todd Amphitheater, U. H.
- 4:30 - ECG Reading Conference; James C. Dahl, et al; Staff Room, Heart Hospital.
- 7:30 - 9:30 Pediatric Cardiology Conference and Journal Club; Review of Current Literature 1st hour and Review of Patients 2nd hour; 206 Temporary West Hospital.

Ancker Hospital

- 8:00 - 10:00 Medical Grand Rounds; Auditorium.

Minneapolis General Hospital

- 9:30 - Neurology Rounds; Heinz Bruhl; Station I.

Thursday, October 29 (Cont.)

Minneapolis General Hospital (Cont.)

- 10:00 - Pediatric Rounds; Spencer F. Brown; Station K.
- 10:00 - Psychiatry Grand Rounds; J. C. Michael and Staff; Sta. H.
- 11:30 - 12:30 Clinical Pathological Conference; John I. Coe; Classroom.
- 1:00 - Fracture - X-ray Conference; Dr. Zierold; Classroom.
- 1:00 - House Staff Conference; Station I.

Veterans Administration Hospital

- 8:00 - Surgery Grand Rounds; Conference Room, Bldg. I.
- 8:00 - Surgery Ward Rounds; Lyle Hay and Staff; Ward 11.
- 11:00 - Surgery-Roentgen Conference; J. Jorgens; Conference Room, Bldg. I.
- 1:00 - 3:00 Metabolic Disease Conference; Drs. Flink, Heller and Sherman.

Friday, October 30

Medical School and University Hospitals

- 8:00 - 10:00 Neurology Grand Rounds; A. B. Baker and Staff; Station 50, U. H.
- 9:00 - 9:50 Medicine Grand Rounds; C. J. Watson and Staff; Todd Amphitheater, U. H.
- 10:30 - 11:50 Medicine Rounds; C. J. Watson and Staff; Todd Amphitheater, U. H.
- 10:30 - 1:50 Otolaryngology Case Studies; L. R. Boies and Staff; Out-Patient Department, U. H.
- 11:00 - 12:00 Vascular Rounds; Davitt Felder and Staff Members from the Departments of Medicine, Surgery, Physical Medicine, and Dermatology; Out-Patient Department, Heart Hospital.
- 11:45 - 12:50 University of Minnesota Hospitals Staff Meeting; The Cobalt Beam Therapy Unit: A Valuable New Tool in Clinical Radiation Therapy; Donn G. Mosser, K. W. Stenstrom, and Halvor Vermund; Powell Hall Amphitheater.
- 1:00 - 2:50 Neurosurgery-Roentgenology Conference; W. T. Peyton, Harold O. Peterson and Staff; Todd Amphitheater, U. H.
- 3:00 - 4:00 Neuropathological Conference; F. Tichy; Todd Amphitheater, U. H.
- 4:00 - 5:00 124 Advanced Neurophysiology Lecture; Werner Koella and Ernst Gellhorn; 111 Owre Hall.
- 4:30 - 5:20 Ophthalmology Ward Rounds; Erling W. Hansen and Staff; E-534, U. H.
- 4:30 - ECG Reading Conference; James C. Dahl, et al; Staff Room, Heart Hospital.
- 5:00 - Urology Seminar and X-ray Conference; Eustis Amphitheater, U. H.

Ancker Hospital

- 1:00 - 3:00 Pathology-Surgery Conference; Auditorium.

Minneapolis General Hospital

- 9:30 - Pediatric Rounds; Wallace Lueck; Station J.

Friday, October 30 (Cont.)

Minneapolis General Hospital (Cont.)

- 10:30 - Pediatric Surgery Conference; Oswald Wyatt, Tague Chisholm; Station I, Classroom.
- 12:00 - Surgery-Pathology Conference; Dr. Zierold, Dr. Coe; Classroom.
- 1:00 - 3:00 Clinical Medical Conference; Thomas Lowry; Classroom, Station M.
- 1:15 - X-ray Conference; Oscar Lipschultz; Classroom, Main Bldg.
- 2:00 - Pediatrics Rounds; Robert Ulstrom; Stations I and J.

Veterans Administration Hospital

- 10:30 - 11:20 Medicine Grand Rounds; Conference Room, Bldg. I.
- 1:00 - Chest Follow-Up Conference; E. T. Bell; Conference Room, Bldg. I.
- 2:00 - Autopsy Conference; E. T. Bell and Donald Gleason, Conference Room, Bldg. I.

Saturday, October 31

Medical School and University Hospitals

- 7:45 - 8:50 Orthopedic X-ray Conference; W. H. Cole and Staff; M-109, U. H.
- 9:00 - 10:00 Infertility Conference; Louis L. Friedman, David I. Seibel, and Obstetrics Staff; Eustis Amphitheater, U. H.
- 9:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; Heart Hospital Amphitheater.
- 9:15 - 10:00 Surgery-Roentgenology Conference; L. G. Rigler, J. Friedman, Owen H. Wangenstein and Staff; Todd Amphitheater, U. H.
- 10:00 - 11:30 Surgery Conference; Todd Amphitheater, U. H.
- 10:00 - 12:50 Obstetrics and Gynecology Grand Rounds; J. L. McKelvey and Staff; Station 44, U. H.
- 11:30 - Anatomy Seminar; Histochemical Studies of Charcot-Leyden Crystals; W. L. Williams; 226 Institute of Anatomy.

Ancker Hospital

- 8:30 - 9:30 Surgery Conference; Auditorium.

Minneapolis General Hospital

- 8:00 - Urology Staff Conference; T. H. Sweetser; Main Classroom.
- 11:00 - 12:00 Medical - X-ray Conference; O. Lipschultz, Thomas Lowry and Staff; Main Classroom.

Veterans Administration Hospital

- 8:00 - Proctology Rounds; W. C. Bernstein and Staff; Bldg. III.
- 8:30 - 11:15 Hematology Rounds; Drs. Hagen and Hoseth;
- 11:15 - 12:00 Morphology Dr. Aufderheide; Conference Room.

* Indicates special meeting. All other meetings occur regularly each week at the same time on the same day. Meeting place may vary from week to week for some conferences.