

VOLUME XXVII • NUMBER 4 • DECEMBER

UNIVERSITY OF MINNESOTA

Medical Bulletin

OFFICIAL PUBLICATION OF THE
UNIVERSITY OF MINNESOTA HOSPITALS
THE MINNESOTA MEDICAL FOUNDATION
AND THE MINNESOTA MEDICAL ALUMNI
ASSOCIATION

IN THIS ISSUE:

Cerebral Metabolism

University of Minnesota Medical Bulletin

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• December 1, 1955 •

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Published semi-monthly from October 15 to June 15 at Minneapolis, Minnesota.

Staff Meeting Report

Ascorbic Acid and Cerebral Metabolism: Some Clues to the Biochemical Significance of Vitamin C*†

Harold P. Cohen, Ph.D.,¹ and Maynard M. Cohen, M.D.²

A new concept of a familiar vitamin has arisen from research designed to explore barbiturate-induced narcosis. Besides its action as a biological redox agent, evidence is presented which indicates that ascorbic acid is involved in the biologic cycle of energy storage and release and may form a high-energy phosphate ester during metabolic activity.

If the postulate is proved, the current view of vitamin C metabolism and function in the animal organism may have to be re-evaluated. For example, the phosphate ester of ascorbic acid might be involved in adrenal hormone synthesis which requires large amounts of high-energy substances. This compound could also be related to adenosine triphosphate, either as a precursor of this substance or even as a new "primary" source of directly utilizable biologic energy.

Impairment of brain respiration by pentobarbital has been explained by two conflicting theories. Persky and co-workers believe that the drug interrupts an enzyme system at the entry of pyruvic acid into the Krebs cycle. Grieg, however, claims that pentobarbital affects the electron-transport system, probably between flavoprotein and cytochrome b, and that ascorbic acid removes the block by providing an electron bypass around the inhibited area.

Initial experiments were intended simply to repeat some of the work done by Grieg. Oxygen consumption of homogenized rat brain was measured in Warburg vessels. However, brain respiration inhibited by pentobarbital was not increased by ascorbic acid, as expected, until cytochrome c was also added to the reaction mixture.

At this point it was decided to test the assumption that ascorbic

*This is an abstract of a report given at the Staff Meeting of the University of Minnesota Hospitals on November 18, 1955. A copy of the complete report, including tables and references, may be obtained by writing to the Editor, UNIVERSITY OF MINNESOTA MEDICAL BULLETIN, 1342 Mayo Memorial, Minneapolis 14, Minnesota.

†This investigation was supported by grant B-435 from the National Institute of Neurological Diseases and Blindness and a grant from the Teagle Foundation.

¹Assistant Professor, Division of Neurology.

²Assistant Professor, Division of Neurology.

acid produces a bypass of the electron block by having an oxidation-reduction potential in the proper range. If such a theory is valid, a compound like cysteine should not be effective because its redox potential is outside the limits of the assumed electrical block. Conversely glutathione should be effective, since its potential is nearly the same as that of ascorbic acid.

Results demonstrate, however, that cysteine behaves like ascorbic acid in relieving pentobarbital inhibition in the presence of cytochrome c while glutathione which should be active, has only a slightly positive effect.

These results plus the fact that brain homogenate contains cytochrome oxidase and that a system containing ascorbic acid (or cysteine), cytochrome c and cytochrome oxidase will take up oxygen, lead to the conclusion that the effect of ascorbic acid observed by Grieg is probably due to a stimulation of the cytochrome oxidase system and not a direct release of the pentobarbital inhibited region.

For full understanding of pentobarbital and ascorbate action on mammalian brain, the formation of high-energy phosphate should be measured, as well as oxygen uptake. This coupling of oxidation with the synthesis of energy-rich phosphate esters is known as oxidative phosphorylation. Tests are performed with the mitochondria of rat or rabbit brain. The mitochondria are microscopic cellular particles containing enzyme systems in some coordinated functional structure and they will oxidize Krebs cycle intermediates and couple the respiration with the synthesis of energy-rich phosphate esters.

Pentobarbital will partially inhibit the production of high-energy phosphate compounds by a respiring mitochondria system. Test results show that ascorbic acid can reduce this "decoupling" effect of pentobarbital on oxidative phosphorylation. This is probably the first report of a substance capable of relieving an inhibited mitochondrial system at the phosphorylating level.

Although ascorbic acid may be acting through the cytochrome system, these results lead to the conclusion that its action must somehow be related to either the stimulation or direct production of some high-energy phosphate compound.

A test system using ascorbate as substrate was then found to phosphorylate in the absence of any known phosphate acceptor system; a limiting value of 1 was observed for the P:O ratio. Adenosine triphosphate was not found in the supernatant of the test system. Since dehydroascorbic acid is inactive and since the oxidation of ascorbic acid was found by other investigators to be a single step reaction to

dehydroascorbic acid, the conclusion is reached that ascorbic acid may itself be phosphorylated.

Ascorbic acid is capable of forming phosphate esters by combination with alcohol groups on carbons 2, 3, 5 or 6. Phosphate esters on C₂ or C₃ are enol phosphates which relates them to the high-energy phosphate bond in phosphoenolpyruvic acid. The synthesis of these theoretically high-energy phosphate esters of ascorbic acid is under way at present in conjunction with Dr. Fred Smith of the Department of Agricultural Biochemistry. These compounds will be tested enzymatically for high-energy phosphate activity.

Work at present includes the isolation and identification of the phosphate-ester formed during ascorbic acid oxidation, a study of the relationship between ascorbic acid and adrenal activity and the relationship between ascorbate and high-energy phosphate synthesis in vivo during pentobarbital anesthesia.

Editorials

Surgery for Congenital Cardiac Defects

The University of Minnesota Hospitals has become an internationally known center of cardiac surgery. The presentation of an Albert Lasker award in November to a team of surgeons from the University only serves to emphasize this fact.

Such a development does not occur overnight. It is the result of patient nurture extending over many years and only now reaching its full flowering. From the beginning, the development of the program has required the support of Dean Diehl and the cooperation of the Department of Pediatrics. This support and cooperation has been generously given.

Dr. M. J. Shapiro and Dr. O. H. Wangenstein led the way. The first congenital cardiac defect treated surgically here was the patent ductus arteriosus. The initial patients were operated upon by Dr. Wangenstein himself. As methods of treating other congenital cardiac defects were developed elsewhere, they were attempted also. Dr. Richard L. Varco gained valuable experience in the management of these cases.

In the meantime, work was begun in the laboratory. The goal: a method of pumping and oxygenating blood so that the heart could be isolated from the general circulation and a defect repaired under direct vision in a bloodless field. Dr. Clarence Dennis and a group of surgical fellows worked in the surgical laboratories for several years perfecting a mechanical pump oxygenator, a mechanical heart lung. Somewhat later Dr. C. Walton Lillehei, Dr. Morley Cohen and Dr. Herbert Warden developed the principle of cross-circulation, a system in which a biological oxygenator, the donor, furnishes oxygenated blood for a period of cardiac bypass during which the recipient's heart is opened under direct vision. It is for the clinical application of this method of repairing congenital cardiac defects that Doctors Lillehei, Varco, Cohen, and Warden were granted the Lasker award.

Simultaneously, Dr. F. John Lewis and a group of surgical fellows were studying the technique of hypothermia and its application to heart surgery. By reducing body metabolism and oxygen requirement by hypothermia, periods of cardiac standstill long enough to permit certain types of intracardiac surgery could be tolerated. Using hypothermia, Dr. Lewis in 1953 became the first surgeon to repair

successfully an intracardiac defect under direct vision in a bloodless field.

In an attempt to eliminate the human donor from the cross-circulation system, but still use a biological oxygenator, Dr. Gilbert Campbell incorporated a dog lung into the circuit. This has proven to be a safe substitute for the human donor-oxygenator. Dr. Raymond Read has shown the suitability of using transfusions of arterialized venous blood from compatible donors when relatively small amounts of oxygenated blood are needed.

Most recently, a satisfactory mechanical bubble oxygenator has been built by Dr. Richard A. DeWall. This apparatus may well supplant the biological oxygenator.

That many of these new developments occurred almost simultaneously and that all these groups were pursuing their varied programs within the framework of the Department of Surgery indicate the tremendous activity and ferment presided over by Dr. Wangenstein. The contributions of Dr. M. B. Visscher and Dr. E. B. Brown to these programs have been outstanding.

The major impact of this work lies ahead in its application to acquired heart disease and, in the case of hypothermia, to the development of new methods of treating advanced cancer.

Rocket-Age Research

"The race is not to the swift — — — —"

Several weeks ago a widely read news magazine featured, in its cover story, an alumnus of the University of Minnesota Medical School. This physician, of whom our faculty can be justifiably proud, has been carrying out truly exciting research on the effects of tremendous rates of acceleration and deceleration on the human body. No observer from the sidelines, he has served as the guinea-pig in the major experiments. His studies have demonstrated conclusively his ability, his imagination and scientific curiosity, and his personal courage, and they will undoubtedly furnish significant and much needed data in this new, rapidly developing branch of medical science.

The magazine story, however, contained a statement which we found disturbing and which we cannot let pass unchallenged. In an apparent reference to his former mentors here and at other institutions where he studied, our alumnus spoke of "pure scientists, . . . prima donnas in universities working in their nit-picking ways at academic doodlings to impress each other." Now, it is not our purpose to at-

tempt to deny that there are prima donnas in the scientific community, for surely there are. Nor can we deny that there are "nit-pickers"; fortunately, we believe, there are many. We will even admit that recognition by his fellow scientists may offer stimulus to an investigator although we believe that the uncovering of a new fact or the development of a new technique or process constitutes in itself the primary stimulus for most research workers.

Our feeling of perturbation stems from the implication that "nit-picking" is an unproductive endeavor, not worthy of the scientific man-of-action who really wants to find out what makes things tick. Nothing could be further from the truth. "Nit-picking," as has been stated many times in many ways, is and always will be the way of the scientist. The great scientific discoveries have, almost without exception, come as a result of the painstaking accumulation of many "nits" of data. This is not always made clear, of course, when these discoveries are reported to the general public. When a bottle of champagne is opened, many twists and tugs are required to loosen the cork; only the final "Pop!" is heard. The absolute necessity for "nit-picking" is well appreciated by those engaged in scientific research. The public, whose support for research is being asked to an increasing extent, must be made to understand and appreciate this necessity, too.

Finally, we would like to point out that our alumnus is himself engaged in "nit-picking." That his test-tube is rocket-propelled does not alter the fact that he is laboriously gathering bits of information. In so doing he is helping to lay the groundwork on which the new space science will be built. Our hats are off to this Mach 0.83 "nit-picker."

Minnesota Medical Foundation

Health Forum

The Minnesota Medical Foundation is pleased to announce the Minnesota Medical Foundation Health Forum, a series of discussions of health problems for the general public to be presented in the Twin Cities during January, February, and March of next year. The series, to be entitled "You and Your Health," will be jointly sponsored by the Foundation, the Hennepin and Ramsey County Medical Societies, the St. Paul and Minneapolis Health Departments, and the Minneapolis Star. DR. R. S. YLVISAKER, *Vice-President of the Foundation*, is Chairman of the Health Forum Committee which includes DOCTORS WESLEY W. SPINK, FRANCIS W. LYNCH, KARL LUNDEBERG, KARL W. ANDERSON, R. B. J. SCHOCH, ROBERT E. PRIEST, ABBOTT SKINNER, and ROBERT B. HOWARD, and MESSRS. M. E. HERZ and ROBERT WEED.

On January 25 in the Theater Section of the St. Paul Auditorium and on January 29 in the Lyceum Theater, Minneapolis, the Forum subject will be "Heart and High Blood Pressure." The February Forum will be held on February 19 in Minneapolis, February 24 in St. Paul, again at the same locations, and the subject will be "Miracle Drugs." The final Forum, dealing with "Cancer" will be presented on March 22 in Northrop Memorial Auditorium on the University of Minnesota campus.

Each Forum will be presented by a panel of four experts, to be drawn from the Medical School Faculty and from physicians practicing in the community. The public has been invited to submit questions and suggestions in advance.

We believe that the Health Forum series, which has been received enthusiastically in other communities, can perform a very real public service. We will welcome suggestions from readers of the BULLETIN as to how the Health Forum can be made most useful and interesting.

Alumni Association

A Note to Our Medical Alumni

It is with very real gratification that I and other members of the Medical School faculty note the increasing activities of the University of Minnesota Medical Alumni Association and the constructive support which this organization is giving to the Medical School. Our alumni are part of the family, in fact, the children of the Medical School. As such, the Medical School takes pride in their achievements and desires their continued interest, friendship, and support.

Under the splendid leadership of recent officers of the Association, such as Doctors Herman Drill, Harold Benjamin and William Bernstein, the Association has published a splendid directory of Medical School alumni and has sponsored an annual luncheon for senior medical students several weeks before their graduation. At this luncheon, each senior student is a personal guest of an alumnus. A brief but stimulating program is presented, and the students are welcomed into the Medical Alumni Association. These luncheons are doing a great deal to lay the basis for improved Medical School-Alumni relations.

Also under the encouragement and leadership of the Alumni Association for the past four years, the class celebrating its 25th Anniversary has contributed a substantial fund to the Medical School to be used for whatever purpose the Dean considers most worthwhile. Upon the recommendation of the Dean and the approval of the Administrative Committee of the faculty, these gifts are being held for the equipment of an Alumni Room in the anticipated Biological-Medical Library. It is our thought that in this room, students and alumni may find the atmosphere and the incentive for interesting browsing and reading in worthwhile medical and related cultural areas.

Such examples of constructive interest and support on the part of our medical alumni are deeply appreciated by the faculty and students and will contribute to a University of Minnesota Medical School of the future in which we all can take very real pride.

HAROLD S. DIEHL, *Dean*

Alumni News

Recently the Minnesota Medical Alumni Association sent out a request to its members for information concerning their professional activities, that is, membership and offices held in national societies,

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offices held in state societies, academic appointments, honors or awards, and other news of note. The response to date indicates that our alumni are engaged in a wide variety of professional activities and that many of them have become leaders of the medical profession in their communities.

This page of the BULLETIN will regularly carry news items of professional significance concerning our alumni. We wish to urge our readers to submit such items to us in order that this page may be of greatest possible interest.

DR. F. DOUGLAS LAWRASON, '44, became *Provost* of the University of Arkansas Medical Center at the beginning of this academic year. Prior to accepting this important post, Dr. Lawrason served as Assistant Dean of the University of North Carolina School of Medicine.

DR. ESTHER M. GREISHEIMER, '22, is *Professor of Physiology* at Temple University School of Medicine in Philadelphia. The 7th edition of her textbook, "Physiology and Anatomy with Practical Considerations," was published in May of this year.

DR. ALLEN R. FOSS, '20, Missoula, Montana, has now retired from active practice after many years of distinguished service. He served as President of the Montana State Medical Association and was a member of the Montana State Board of Medical Examiners. He holds honorary membership in the Federation of State Medical Boards and honorary life membership in the Lutheran Brotherhood in recognition of service to the Evangelical Lutheran Church.

DR. PAUL T. ERICKSON, '31, Atlanta, Georgia, was recently appointed a member of the Medical Advisory Board of the Leonard Wood Memorial (American Leprosy Foundation) of New York City.

DR. ETHEL E. ERICKSON, '46, is *Assistant Professor of Pathology* at Baylor University College of Medicine and Assistant Chief of the Laboratory Service at the Houston Veterans Administration Hospital.

DR. IRVING F. ENQUIST, '43, a former member of our faculty, is a member of the faculty of the State University of New York College of Medicine at New York City as *Associate Professor of Surgery*.

DR. GEORGE E. BROWN, JR., '38, Twin Falls Idaho, is Past President of the Idaho Heart Association.

DR. J. C. HATHAWAY, '25, Spokane, Washington, is Past President of the Pacific Northwest Dermatologic Society.

DR. JAY JACOBY, '41, is *Professor and Director of the Department of Anesthesiology*, Ohio State University, Columbus, and Vice-President of the Ohio Society of Anesthesiologists.

Medical School Activities

Awards

The American Public Health Association announced this week that an Albert Lasker Award had been made to a group of surgeons from the University of Minnesota Medical School. DOCTORS C. WALTON LILLEHEI, RICHARD L. VARCO, MORLEY COHEN, now of Winnipeg, and HERBERT E. WARDEN were cited for their development of the cross-circulation technique and other procedures which have allowed safer bloodless surgery within the heart.

DR. ROBERT A. GOOD, *American Legion Heart Research Professor in Pediatrics*, has been awarded the 1955 Theobald Smith medal and prize for outstanding contributions in the field of medical science. This \$1,000 prize and medal is awarded at intervals by the medical science section of the American Association for the Advancement of Science and is sponsored by the Eli Lilly Company.

DOCTORS F. H. VAN BERGEN and J. J. BUCKLEY, *Department of Anesthesiology*, and representatives of the Smith Welding Equipment Corporation were awarded first prize for their exhibit demonstrating the structure and use of their new respirator at the meeting of the American Society of Anesthesiologists held from October 29 through November 2 in Boston.

New Cancer Hospital Planned

Minnesota's 68,000 Masons recently opened a drive for funds for a million dollar Masonic Memorial Cancer Hospital which will be a part of the University of Minnesota Medical Center. The 50-bed institution, described by DEAN DIEHL as "not only a humanitarian enterprise but a valuable research and teaching addition to the University," will care primarily for patients in the advanced stages of cancer.

DR. DONALD J. COWLING, *President Emeritus of Carleton College*, who was so instrumental in bringing the Mayo Memorial project to fruition, is Chairman of the Masonic Cancer Relief Committee of Minnesota, in which 300 units of the order will participate. The Masonic drive has a goal of \$500,000 from individuals and groups. The remainder of the estimated cost is expected to be provided by federal funds on a matching basis.

Faculty News

Minnesota was well represented at the recent meeting of the Association of American Medical Colleges in Swampscott, Massachusetts. DR. H. S. DIEHL, *Dean*, DOCTORS WILLIAM F. MALONEY and N. L. GAULT, JR., *Assistant Deans*, and DR. ARNOLD LAZAROW, *Professor and Head of the Department of Anatomy*, attended. Dr. Diehl was elected Vice-President of the Association. Dr. Lazarow participated in a teaching institute on the teaching of anatomy which was held prior to the Association meeting and later addressed the Association on "The Influences of Advances in Medical Sciences on Anatomical Teaching." Among former Minnesotans in attendance were DR. GEO. N. AAGAARD, *Dean*, University of Washington Medical School; GORDON SCOTT, PH.D., *Dean*, Wayne University Medical School; DR. F. DOUGLAS LAWRASON, *Provost*, University of Arkansas Medical Center; DR. RAYMOND GREGORY, *Professor of Medicine*, University of Texas Medical School, Galveston; DONALD DUNCAN, PH.D., *Professor of Anatomy*, University of Texas Medical School, Galveston; and O. P. JONES, PH.D., *Professor of Anatomy*, University of Buffalo Medical School.

DR. ROBERT N. BARR, a 1929 graduate of the University of Minnesota Medical School, was recently named *Executive Officer of the Minnesota Department of Health*, succeeding DR. A. J. CHESLEY who died on October 17. Dr. Barr joined the Health Department in 1934 after three years in general practice in Montana. During World War II he commanded the Sixth Medical Laboratory in the Pacific theater. Following discharge from the armed forces he returned to the Health Department where he became Deputy Executive Officer in 1949.

DR. WESLEY W. SPINK, *Professor, Department of Medicine*, left on November 18 for Tunisia, the first stop on a three-weeks' trip to Africa and Europe where he will study and lecture on brucellosis. At the invitation of the Tunisian government and the World Health Organization, he will survey an extensive research program of brucellosis in sheep and goats being conducted at the Pasteur Institute in Tunis. Dr. Spink also will fulfill an invitation to address the British Medical Association in Malta, and he will lecture on brucellosis at the Royal University Medical School at Valletta, Malta. From Malta, he will travel to England, where he will lecture on brucellosis at the London School of Tropical Medicine and Hygiene.

DR. JOEL G. BRUNSON, *Instructor, Department of Pathology*, attended the American Heart Association Meetings in New Orleans October 22 to 26. MR. RICHARD L. DAVIS, a senior medical student who

has collaborated with Dr. Brunson in experiments conducted under the auspices of the American and Minnesota Heart Associations, accompanied Dr. Brunson and presented the results of their research efforts, "Production of Cardiac Lesions in Rabbits by the Intravenous Administration of Meningococcal Endotoxin and Endotoxin in Association with the High Molecular Weight Polymer Liquoid." On a side trip to Birmingham, Alabama, they made clinical ward rounds with DR. TINSLEY HARRISON and participated in a conference on the so-called "collagen diseases."

DR. KARL R. JOHANSSON, *Associate Professor, Department of Bacteriology and Immunology*, participated in a panel discussion on Penicillin V at the Antibiotics Symposium sponsored by the Food and Drug Administration, Washington, D. C., November 2 to 4.

On October 5 DR. ELIZABETH M. CRANSTON, *Assistant Professor of Pharmacology*, gave a lecture on the subject "Adrenal Cortical Hormones" at a meeting of the Aberdeen, South Dakota, District Medical Society.

DR. JEROME T. SYVERTON, *Professor and Head, Department of Bacteriology and Immunology*, presented by invitation a paper, "Cells in Continuous Culture for the Study of Viruses," at the Fourth Annual Meeting of the American Society of Tropical Medicine and Hygiene, Boston, November 3 to 6.

DR. ARNOLD LAZAROW, *Professor and Head, Department of Anatomy*, gave a lecture on "Diabetic Toadfish: Their Role in Studies on the Etiology of Diabetes Mellitus," at the Marine Biological Laboratories, Woods Hole, Massachusetts on August 12.

The Minnesota Society for Neurology and Psychiatry has elected DR. ROYAL C. GRAY, *Clinical Professor, Division of Neurology*, its President for the coming year. DR. WALLACE P. RITCHIE, *Clinical Associate Professor, Division of Neurosurgery*, was named Vice-President, and DR. JOSEPH A. RESCH, *Clinical Associate Professor, Division of Neurology*, Secretary-Treasurer.

DR. DONN G. MOSSER, *Assistant Professor, Division of Radiation Therapy*, returned on November 1 from Europe. During the past 15 months he has been studying at various European centers as an American Cancer Society Fellow.

DR. J. T. SYVERTON, *Professor and Head, Department of Bacteriology and Immunology*, participated in a "Symposium on Host Factors in Resistance" by presenting a paper entitled "Immunological Aspects

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of Resistance to Tumors" at the Eighth Annual Scientific Meeting of the Detroit Institute of Cancer Research on October 17 and 18.

DR. K. W. STENSTROM, *Professor and Head*, and DR. HALVOR VERMUND, *Assistant Professor, Division of Radiation Therapy*, gave a refresher course at the meeting of the American Roentgen Ray Society in Chicago on September 21. Subject of their course was "Radiation Effects on Malignant Tumors."

DR. DAVID GLICK, *Professor, Department of Physiological Chemistry*, presented a lecture on October 1 at the Department of Biochemistry of Tulane University on "Quantitative Histochemical Studies on the Adrenal." He also attended the meeting of the American Heart Association in New Orleans from October 22 to 24.

DR. K. R. JOHANSSON, *Associate Professor, Department of Bacteriology and Immunology*, presented by invitation a paper concerned with the mode of action of antibiotics on animal growth at the International Conference on the Use of Antibiotics in Agriculture, sponsored by the National Academy of Sciences and the National Research Council, and held in Washington, D. C., October 19 to 21.

DR. FRANK MORRELL, *Instructor, Division of Neurology*, has left for Marseilles, France, where he will participate in a colloquium on the neurophysiology of the higher nervous activity.

Two distinguished physicians have been visitors to the Department of Medicine recently. DR. C. BRUCE PERRY, *Professor of Medicine, University of Bristol, England*, was here from October 17 to 21. DR. M. M. WINTROBE, *Professor and Head of the Department of Medicine, University of Utah Medical School*, was a visitor on November 1.

DR. RUTH V. JOHNSTON, *Associate Professor of Nursing*, was a member of the planning committee and panel participant at a two-day conference on Personnel Services in Schools of Nursing sponsored by the Minnesota League for Nursing, November 3 and 4.

MISS MARGERY LOW, *Coordinator of Rural Nursing Programs in Minnesota*, has just returned from Guatemala where she visited DR. RENA BOYLE, formerly of the School of Nursing faculty and now *Nursing Consultant with the United States Overseas Mission to Guatemala*. She also visited the new 1000-bed Guatemalan Government hospital which is scheduled to open soon.

Postgraduate Education

Obstetrics for General Physicians

The University of Minnesota will present a continuation course in Obstetrics for General Physicians at the Center for Continuation Study from January 5 to 7, 1956. Guest faculty will include DR. LANCE TOWNSEND, *Professor and Head, Department of Obstetrics and Gynecology, University of Melbourne Faculty of Medicine, Melbourne, Australia.* The course will be presented under the direction of DR. JOHN L. MC KELVEY, *Professor and Head, Department of Obstetrics and Gynecology.*

Neurology and Neurosurgery for General Physicians and Specialists

Neurology will be the subject of a continuation course to be presented by the University of Minnesota at the Center for Continuation Study from February 6 to 11, 1956. Intended primarily for physicians in general practice, the program will have appeal also for neurologists and neurosurgeons. The most commonly seen neurological symptoms and syndromes will be stressed. Guest faculty will include DR. WILLIAM M. MEACHAM, *Associate Clinical Professor of Surgery, Vanderbilt University School of Medicine, Nashville;* DR. MORRIS B. BENDER, *Director, Neurology Service, Mount Sinai Hospital, and Professor, Clinical Neurology, New York University College of Medicine, New York City;* DR. JOHN F. SULLIVAN, *Associate Professor and Head, Department of Neurology, Tufts College Medical School, Boston;* and DR. OLIVER H. LOWRY, *Professor and Head, Department of Pharmacology, Washington University School of Medicine, St. Louis.* The course will be presented under the direction of DOCTORS A. B. BAKER, *Professor and Director, Division of Neurology,* and WILLIAM T. PEYTON, *Professor and Director, Division of Neurosurgery.*

Notice

All continuation courses presented by the University of Minnesota are approved for formal postgraduate credit by the AMERICAN ACADEMY OF GENERAL PRACTICE. Attendance certificates will be furnished on request.

Further information concerning the above programs or others to be presented may be obtained by writing to Dr. Robert B. Howard, 1342 Mayo Memorial, University of Minnesota, Minneapolis 14.

Coming Events

- January 5-7 Continuation Course in Obstetrics for General Physicians
- January 30-
February 1 Continuation Course in Emergency Surgery
for General Physicians
- February 2-4 . . . Continuation Course in Mental Deficiency for
General Physicians, Pediatricians, Obstetri-
cians, and Child Psychiatrists
- February 6-11 . . . Continuation Course in Neurology and Neuro-
surgery for General Physicians and Specialists
- February 8 J. B. JOHNSTON LECTURE; *Dr. Oliver H.*
Lowry, Professor and Head, Department of
Pharmacology, Washington University School
of Medicine, St. Louis, Missouri; Mayo Mem-
orial Auditorium; 8:15 P.M.
- February 13-15 . . Continuation Course in Internal Medicine for
Internists
- February 16-18 . . Continuation Course in Cancer Detection for
General Physicians
- February 27-29 . . Continuation Course in Eye, Ear, Nose, and
Throat for General Physicians

WEEKLY CONFERENCES OF GENERAL INTEREST

Physicians Welcome

- Monday, 9:00 to 10:50 A.M. OBSTETRICS AND GYNECOLOGY
Old Nursery, Station 57
University Hospitals
- 4:00 to 6:00 P.M. ANESTHESIOLOGY
Todd Amphitheater,
University Hospitals
- Tuesday, 12:30 to 1:20 P.M. PATHOLOGY
104 Jackson Hall
- Thursday, 12:00 to 1:00 P.M. PHYSIOLOGY
214 Millard Hall
- Friday, 8:00 to 10:00 A.M. NEUROLOGY
Station 50, University Hospitals
- 9:00 to 10:00 A.M. MEDICINE
Todd Amphitheater,
University Hospitals
- 1:30 to 2:30 P.M. DERMATOLOGY
Eustis Amphitheater,
University Hospitals
- Saturday, 7:45 to 9:00 A.M. ORTHOPEDICS
Powell Hall Amphitheater
- 9:15 to 11:30 A.M. SURGERY
Todd Amphitheater,
University Hospitals

For detailed information concerning all conferences, seminars and ward rounds at University Hospitals, Ancker Hospital, Minneapolis General Hospital and the Minneapolis Veterans Administration Hospital, write to the Editor of the BULLETIN, 1342 Mayo Memorial, University of Minnesota, Minneapolis 14.