Carl J. Wiggers, M. D.
A Biographical Sketch

The Dean of American Physiology, and by adoption, of Cardiology, Carl John Wiggers, was born in Davenport, Iowa, on May 28, 1883. He was one of the two children of George and Margaret Kuendel Wiggers. George Wiggers had left Germany because of the lack of opportunity in his native land, and had sought America and the growing city in Iowa where many of his fellow countrymen had settled.

Carl Wiggers grew up and went to school in Davenport, was graduated from the local high school and then matriculated in the Medical School of the University of Michigan, from which he was graduated in 1906. The origin of his interest in physiology, while a medical student, he described in his Past-President's Address at the fall meeting of the American Physiological Society at Columbus, Ohio, September 15, 1950:

My interest in physiology as a science was not awakened by lectures or reading connected with regularly scheduled courses but through an educational experiment conceived by Lombard (Professor of Physiology, University of Michigan) in 1902. The experiment consisted in assigning to each group of two students a research problem to be carried out during the last two weeks of a laboratory course. My partner and I were to investigate the debated question, whether the knee jerk is due to reflex excitation or to direct stimulation of the quadriceps maintained in reflex tonus. Of course, little progress was made during the short time available, but, my curiosity having been aroused, permission was given to pursue the quest independently in the evenings and on weekends. A new and simple method for inscribing an isometric contraction of the quadriceps, by the same system that recorded the tap, was devised. The technique is still being used in my laboratory courses for medical students.

While these investigations were being carried out, Professor Cushny, of the Department of Pharmacology, granted him the privilege of assisting in experiments on free afternoons. The duties consisted largely of smoking kymograph papers and cleaning up after the experiments. In Wiggers' own words:

The stipend was nil, but the recompense for these services was large, for it afforded the opportunity to learn how a great experimenter observes, ponders, and deducts from his observations; for Cushny, as history records, was a pioneer in basic physiology as well as in experimental pharmacology.

The association with Lombard and with Cushny could not but help to influence his medical career.

At the beginning of his junior year Wiggers resolved to engage eventually in obstetrics and pediatrics—then a joint specialty. This course was deflected by the resignation of the only instructor in the Department of Physiology, for Wiggers was appointed half-time student assistant. While helping to conduct the laboratory work, he nevertheless found time to start his own personal research on the innervation of the cerebral vessels. At the annual meeting of the American Physiological Society at Ann Arbor in December 1905, he demonstrated that epinephrine constricts the cerebral arteries.

Lombard appointed Wiggers Instructor in Physiology and, despite academic duties, he found time to investigate the innervation of the coronary and the pulmonary vessels. He remained at the University of Michigan until 1911. During those years he published 13 papers, the first of which in 1905 was On The Action of Adrenalin on the Cerebral Vessels.

A former student of his during that period recently commented that Doctor Wiggers was "an excellent teacher, kind and stimulating." A sabbatical leave was granted Prof. Lombard in 1910, and during that year Wiggers was appointed Acting Director of the Department of Physiology. He initiated what was then a bold didactic experiment—correlating basic...
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physiology with its clinical application. He pioneered this approach to the teaching of physiology on the basis, as he stated, that

... every disease is an experiment that nature performs, and its signs and symptoms are the manifestations of abnormal function. Medical students during their training in physiology should be inspired with the ambition not merely to interpret such clinical signs, but to see through them on the basis of evidence furnished by experimental work.

While at Michigan, Wiggers supplemented his small academic salary by what he could earn in the general practice of medicine, a practice that necessarily was restricted, for his obligations to the university had priority. Perhaps this rigorous experience accounts for his sympathy for young practitioners in their love of the laboratory, and his hope that some perhaps would make physiology their full-time careers.

While at Michigan as a student, Wiggers met an attractive physician, Minerva E. Berry. They married, and she became his life-long helpmeet—ever submerging her own career to further her husband’s interests and ambition. Two sons grace their marriage.

During the middle of his administrative year Wiggers was offered two professorships. He discussed these opportunities with Dr. Huber, and with Dr. Mall (a guest of Huber). Dr. Mall commented on the one offer: ‘I know nothing whatsoever about you, but, if you are good, the school is not good enough for you; if you are good, the school is too good for you.’ Regarding the second offer, Professor Novy advised: ‘You are too young to be sitting in a chair; wire back concerning the status of their laboratory stools.’ Wiggers’ own advice to his young associates has ever been, ‘Resist acceptance of positions in which advancement is apparent rather than real.’

During these years at Michigan, Wiggers attracted the attention of Professor Howell, of Johns Hopkins University, who recommended him for an instructorship at Cornell Medical College in New York. Wiggers believes that this opportunity came from the quality and the manner of his presentations before the American Physiological Society, and stated that, ‘Youngsters may be reminded that it is still common practice to select and promote physiologists on the basis of their public performances at scientific meetings.’ He believed that the new post offered three great opportunities:

... (a) association with a leading physiologist who had achieved a reputation for fostering research, both in basic sciences and in clinical fields, and who, though not himself a medical man, had exerted a profound influence on clinical medicine in New York City; (b) membership in a department with a light teaching load... so that two-thirds of the academic year was available for pursuit of research; and (c) venture in a new field of training, namely, that of nutrition, in which Lusk and his group were masters.

The willingness to change his research interest was prompted by a belief that the recording apparatus then currently used in cardiovascular research was inadequate, whereas the respiration calorimeters used on problems of nutrition seemed more likely to furnish precise information. But this change in fields of research did not occur, for Lusk desired to broaden the activities of the Department of Physiology, and therefore made it possible for Wiggers to continue with his work on circulation. Wiggers met H. B. Williams, Professor of Physiology at the College of Physicians and Surgeons of Columbia University, who was interested in the string galvanometer of Einthoven. A few years later one of the first three galvanometers designed by Williams was obtained by Wiggers. In his desire for new and better apparatus for recording dynamic changes in the circulation, Wiggers’ attention was attracted to the recording devices of Otto Frank in Munich. Lusk was sympathetic to this interest and arranged for Wiggers to enter Frank’s laboratory during the last part of his first year at Cornell, with continuation of his salary. That year with Frank, and with opportunities extended by Garten in Giessen, gave Wiggers
the training that in later years was to influence his work so greatly.

In 1915, Wiggers wrote an important monograph entitled *Modern Aspects of the Circulation in Health and Disease*, published by Lea & Febiger. This work he dedicated to his wife with the following heartfelt inscription: "To Mrs. Wiggers the author is especially indebted for many faithful hours of help rendered in preparing the manuscript."

During the years in New York, Wiggers frequently attended the meetings of the Harvey Society of New York, and the Society for Experimental Biology and Medicine, and made many life-long friends.

Taking care of a wife and two growing sons in New York City on the small salary of even an Assistant Professor posed economic problems. There arose the question of whether to deflect to commercial fields or to medical practice. Lusk's advice was, "Hold off until forty, then if not in a favorable academic position with tenure for life, consider such a change carefully."

During World War I, Professors Lusk and Murlin were away in service, and Wiggers' administrative and teaching activities again became heavy. What little spare time he had was spent in research on shock. During the spring and summer of 1918 Wiggers, as Contract Surgeon, was in charge of electrocardiography at General Hospital No. 9 at Lakewood, New Jersey. We recall his study of "The Soldier's Heart," now called neurocirculatory asthenia.

While at Cornell, Wiggers' basic experimental work kept him busy in all of his spare time. He published many papers—notably on the newer methods of pressure recording, the experimental production of valvular lesions, pulse contours, observations on the constricting action of adrenaline on the cerebral vessels, pathologic physiology of the circulation during hemorrhage, pressure studies in atrial fibrillation, dynamics of aortic insufficiency, the auricular myogram, the venous pulse in atrial fibrillation, registration of cardiac sounds, fat emboli and shock, circulatory failure in abdominal shock.

In the fall of 1918, the Professorship of Physiology at Western Reserve University became vacant when Professor J. J. R. McLeod took the post in Physiology at the University of Toronto. Doctor Sollmann of Western Reserve comments: "We sought for a man of ideas and ideals, and of ability to carry them out." Wiggers was invited to take the chair at Western Reserve and he and his family went to Cleveland, where he has remained ever since. He was 35 years old at the time.

In 1925 the new Medical School building was opened on the Western Reserve University campus on Adelbert Road. Wiggers spent much time in planning space for the Department of Physiology, which occupied one half of the fourth floor, covering more than 15,000 square feet. Doctor McLeod already had planned the layout, so that the final arrangements combined the ideas of the two men. Appropriate space was provided for lecture room and shops, for students' laboratories, and for research. In this modern plan Wiggers believed, he said, that he had provided for

\[ \ldots \text{three main functions: To offer students the broadest training in the application of physiological principles in medicine, to contribute actively and regularly to the advance of physiological knowledge, and to develop physiologists of the future among the junior staff.} \]

He felt that "It was the duty of Medical Educators to do more than offer students a background in physiology which is just sufficient for their needs in medicine." In other words, he was providing educational facilities in physiology not only for future physicians, but for the training of future physiologists. To him, physiology had

\[ \ldots \text{established her claim to be recognized with pathology as one of the basic sciences underlying clinical medicine and surgery that no one should now enter these fields without an apprenticeship of a year or two in a physiology laboratory.} \]

Prominent on the wall of the corridor leading to the Department of Physiology is a
framed sign reading "Observe, Describe, Reflect, Deduct, Verify"—his motto.

The staff of the Department of Physiology grew, as did the size of the classes, and the roster included, over the years, many developing teachers and investigators. Nothing pleased Wiggers more than to see men and women trained by him go on to important research and teaching positions all over this country and, in fact, the world. At the last recent count, 26 of his former students have become professors or heads of departments, and one has received a Nobel Prize. As evidence of continued loyalty and respect to him, his former students and associates customarily arrange an annual dinner meeting in connection with the meeting of one of the national societies.

Wiggers himself grew steadily in reputation. He traveled to Belgium, England, Germany, Holland, India, Java, China, Japan, Chile, Cuba and Mexico in response to invitations to lecture. In this country he has become a much-sought-after lecturer and, to this day, the invitations arrive with great regularity.

During the era at Western Reserve, Wiggers engaged in many important research activities, among which were: The Contour of the Ventricular Volume Curves under Different Conditions (1922); The Cardiodynamics of Mitral Insufficiency, A New Universal Optical Manometer, and The Fundamental Nature of Premature Ventricular Contractions in the Dog (1925); The Cause of Temporary Ventricular Alternation Following a Long Diastolic Pause (1927); Studies on the Cardiodynamic Actions of Drugs (1927); The Dynamics of Ventricular Alternation (1927); The Harmonic Analysis of Intraventricular Pressure Curves (1928); Observations on Experimental Aortic Insufficiency (1931); The Circulatory Effects of Acute Experimental Hypervolemia (1933); The Coronary Pressure Pulses (1933); The Effect of Coronary Occlusion on Myocardial Contraction (1933); Ineffectiveness of Drugs Upon Collateral Coronary Flow (1936); The Dynamics of Hypertension (1938); Ventricular Fibrillation from Single Localized Induction and Condenser Shocks Applied During the Vulnerable Phase of Ventricular Systole (1940); Physiologic Basis for Cardiac Resuscitation from Ventricular Fibrillation—Method for Serial Defibrillation (1940); Hemorrhagic Shock (1942); The Ineffectiveness of Adrenal Cortex Extracts in Standardized Hemorrhagic Shock (1943); The effects of Renin and Angiotensin on Cardiac Output and Total Peripheral Resistance (1944); The Failure of Transfusions in Irreversible Hemorrhagic Shock (1945); Myocardial Depression in Shock (1947); The Problem of Functional Coronary Collaterals (1950); Basic Hemodynamic Changes Produced by Aortic Occlusion (1951); Determinants of Cardiac Performance (1951); Functional Importance of Coronary Collaterals (1952); The Effects of Progressive General Anoxia on the Pulmonary Circulation (1953); and The Interplay of Coronary Vascular Resistance and Myocardial Compression in Regulating Coronary Flow (1954).

What have been the over-all results of Carl Wiggers' ideas of serving medical education, of training young physiologists, and of conducting research? His insistence that the students be helped to develop fundamental concepts has enabled them to carry away from his classrooms and laboratories at Michigan, at Cornell, and at Western Reserve, not only the facts of life but also the wherefore. Kindly, humane, but at the same time exacting, Carl Wiggers has insisted on precision, and has focused on deductive reasoning and possible clinical application. Throughout his 35 years of teaching he has maintained high standards of values. He has aided in the education and has been the inspiration of large numbers of physicians, all of whom will always remember him. His lectures were carefully prepared and were constantly revised to include discussion of the latest concepts. Students did not go to sleep in his classrooms. He frequently injected into the lecture some apropos and amusing story. One of these concerned the reaction of students to a lecture: if a student took his watch out to note the time, he was not offended, but when the student shook the watch or placed it to his ear, he would conclude that his lecture was less absorbing than he had planned!

While Wiggers' activities were primarily those of teaching and research, he found time not only to publish nearly 400 scientific reports, but also to write many books. His first book was a Brief Text of Physiology pub...
lished while he was at Michigan (1910). The second was Circulation in Health and Disease, the first edition of which was published in 1915, the second in 1923. Pressure Pulses followed in 1928; Principles and Practice of Electrocardiography came in 1929; Physiology in Health and Disease in 1934, the fifth edition appearing in 1949. Physiology of Shock appeared in 1950 and his seventh book, Circulatory Dynamics, appeared in 1952. Meanwhile Wiggers contributed to Nelson's Loose-Leaf Living Medicine in 1920, Abt's Pediatrics in 1924, the White House Conference on Child Health and Protection in 1933, and Clinical Aspects of Diseases of the Coronary Arteries and Cardiac Pain (edited by R. L. Levy) in 1936.

Doctor Wiggers' teaching and investigative work on the normal and pathologic aspects of the circulation continued uninterruptedly for 35 years except for four visits to European congresses and laboratories, a six-month sabbatical leave in 1938 for a trip around the world, and an invitational trip to Argentina. Before this trip he studied Spanish so that he could give his lectures in the native tongue. Upon his return to Cleveland, to celebrate his twentieth year at Western Reserve University, a surprise reception and tea was given in his honor on November 19, 1938, in the Department of Physiology. Speeches and felicitations were given and a volume of letters and photographs of his associates was presented to him.

Wiggers took much interest in the founding of The American Heart Journal in 1925 by the American Heart Association. He was on the original Advisory Editorial Board and remained a member until 1937. In the December, 1925, issue of the Journal he published a paper on The Independence of Electrical and Mechanical Reactions in the Mammalian Heart. In this paper he concluded "... that electrical variations are an accompaniment of impulse conduction which precedes the actual contraction process by a definite interval." This work confirmed the observations of Lewis and Rothchild and challenged those of Einthoven and his associates who attributed the interval between electrical and mechanical recording largely to the fact that the sensitivity of apparatus used to record mechanical changes did not equal that of apparatus employed to reveal electrical variations.

Carl Wiggers, appreciating the great need for the training of more students in circulatory physiology, organized a course for Cardiovascular Investigators under the cosponsorship of the United States Public Health Service and the American Heart Association. This training course was conducted in his laboratories from 1949 to 1952.

He is a member of many societies, both here and abroad, including the National Academy of Science, and was President of the American Physiological Society (1949) and Vice President of the American Heart Association (1947). Currently he is President of the Inter-American Cardiological Congress. His administrations in public office have been clear-headed, vigorous and tolerant and his ever-present gentle—and sometimes not so gentle—wit has rescued many a difficult situation.

Wiggers has been the recipient of several honorary degrees: Doctor of Science, The University of Michigan (1941); Honorary Doctorate, Ludwig Maximilian University of Munich (1953), and of the University of Brussels (1956). Many honors have been bestowed on Wiggers, including the Gold Heart Award in 1952 and the Albert Lasker prize in 1955 by the American Heart Association.

In the spring of 1952 faculty, colleagues, students, and admirers everywhere proposed that a portrait of Doctor Wiggers be painted. This was accomplished by John C. Johansen in the summer of 1952 and presented to the Medical School of Western Reserve University at an afternoon reception in honor of Dr. and Mrs. Wiggers on October 18, 1952. After a short address of presentation by Dr. Harold Green, Dr. Normand L. Hoerr accepted the portrait on behalf of the faculty. Dr. L. N. Katz then announced that from contributions a fund had been established for an award to be bestowed annually as The Minerva and...
Carl Wiggers Prize in Physiology. A large group acclaimed Dr. and Mrs. Wiggers. The portrait is now in the Library of the Department of Physiology.

An editorial comment on the occasion ran as follows:—

Dr. Wiggers truly has been a giant in his field. Author, pioneer researcher in the heart and blood vessel field, his monument is the hundreds of great students sent into the world imbued with his own philosophy and the values of precision, promptness, hard work and thoroughness. All over the world his work will continue in many other of the leading physiologists, even after his retirement.

Warm, friendly, and fatherly, he has never compromised his views, no matter who might disagree. He leaves to Western Reserve a great heritage and an indelible imprint.

With the close of the academic year of 1953 Wiggers' university career came to an end. Many will recall his marching in the Commencement procession. It was a poignant moment for students, faculty, and friends—for Carl Wiggers, too. But the severance also marked the beginning of a new career. Wiggers was made Editor of the journal, Circulation Research, newly founded by the American Heart Association. In five brief years he has succeeded in making this journal one of the most important in basic scientific literature. His high standards permitted acceptance only of papers having real, basic importance. Wiggers took his editorship seriously, and authors have accepted with gratitude and appreciation his reviews and criticisms of their presentations. His office, and the office of the journal since his retirement from Western Reserve, have been at The Cleveland Clinic Foundation, a group that was delighted to have him join them as Honorary Professor of Physiology in their post-graduate medical training program sponsored by the affiliated Frank E. Bunts Educational Institute. In this academic capacity, and as Editor of Circulation Research, Wiggers has continued actively to teach, to serve as consultant on research problems, to contribute regularly to other scientific journals, and to lecture frequently throughout this country, as well as abroad. Perhaps especially notable in these recent years are his series of timely and thoughtful editorials that appeared in Circulation Research, and his outstanding Harvey Tercentenary Lecture, The Impact of Harvey and his Work on Circulation Research, given before the Harvey Society in New York on June 6, 1957, when he received a Harvey Medal struck for the occasion. While his editorship of Circulation Research was terminated at his request after five years ending December, 1957, he feels that his work is far from ended. His central base of activity will remain at the Cleveland Clinic where he will continue with the writing of many of his unrecorded researches, and with teaching, consulting, and lecturing. If he were still in the laboratory full time, his researches might well involve the physiology of space travel, and integration with the astronomers and spatial experts. But, in the laboratory or out of it, Carl Wiggers will go on adapting himself to the changing environment of science—never aging and always looking for new problems and new methods of solving them.

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