

Contributions of the Mayo Clinic in World Wars I and II

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President Zimble, Dean Gary, Dr. Rich, members of the Surgical Associates:

It has been a great pleasure for me to be identified with the Surgical Associates of the Uniformed Services University Medical School, and, in particular, the Department of Surgery and its Chief, Dr. Norman Rich.

The career medical officers, over the years, have contributed greatly to the care of the men and women in the military services, namely the U.S. Army, Navy, Marines, Air Force, and Coast Guard. Supplementing their contributions to the health and welfare of those serving their country has been a large medical contingent from the public. Those in the Army and Navy Reserves from the medical community have served during the periods in which our country has participated primarily in military conflicts.

Although contributions have come from practically every medical school, medical organizations, clinics, and individual doctors, I have taken the liberty of making my remarks primarily regarding a few of the contributions of the institution with which I have been associated for 50 years. In making these comments, I in no way depreciate the many and valuable contributions made by so many others, especially during World War I and World War II. Similar comments to those that I will make regarding Mayo could be made by so many other institutions. I pay credit for their contributions even though they will not be mentioned.

The Mayo story starts in 1863, when Dr. W. W. Mayo

was assigned as a Civil War medical examiner in Rochester, Minnesota (Fig. 1). In that year, he left his practice in Le Sueur, Minnesota, in the western part of the state, and came to Rochester to serve in this capacity. After the Civil War, enjoying the small town in southeastern Minnesota, Dr. Mayo elected to establish his practice in this area. His decision to do so cast the die as to why the Mayo Clinic subsequently was established and developed in this small town, said to be in a corn field in a large farming area, and, for the most part, this remains true.

Subsequently, when Dr. W. J. Mayo graduated from Michigan Medical School, he joined his father in practice in Rochester, to be followed a few years later by Dr. Charles H. Mayo, after his graduation from Northwestern University Medical School. The Mayo practice grew significantly in this part of Minnesota because of the otherwise lack of medical service or facilities. In 1883, a tornado passed through Rochester, causing many casualties and much destruction. This event led to the establishment of the first hospital in this region. In 1889, Saint Mary's Hospital, sponsored by the Catholic order of St. Francis, was opened. With a medical facility available to the Mayos in this rural area, the practice gradually grew. Because of the increasing demand for their services, others were added to the staff. At first, the practice was known as a partnership among the seven original members, but subsequently, Mayo became a public institution when the Mayo Foundation was formed in 1915.

With war clouds developing in Europe, Dr. Will (age 51) and Dr. Charlie (age 46) both joined the Army Reserve in 1912 and were commissioned as first lieutenants. With the war in progress in 1916 in Europe, a committee of American physicians for medical preparedness was formed for preparations for peace. Dr. Will was elected Chairman of this group, and the services were offered to the country and accepted by President Wood-

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row Wilson. The duties of this general medical board were to select sites of cantonment, make recommendations regarding medical training in France, aid in recruiting medical officers, and assign or place qualified surgeons in units so that surgical services would be available to all military personnel. Also, the group made a survey of American hospital and medical personnel at the request of the Surgeon General of the Army. This led to the beginning of enlisting civilian doctors in the medical reserve.

Also, in August 1916, the Council of National Defense was established by act of Congress to serve as a civilian advisory committee to the defense effort. This led to the formation of a General Medical Board of the Council, which was comprised of 39 outstanding members of the medical profession. Subsequently, this was increased to 87 members. Dr. W. J. Mayo became Chairman of the Executive Committee of the General Medical Board.

The Surgeon General of the Defense Department at this time was William C. Gorgas, of yellow fever fame. Figure 2 identifies members of the General Medical Board. Dr. W. J. Mayo served as Chairman of the Executive Committee.

At first, each of ten members served in Washington at



Figure 1. Dr. W. W. Mayo, about the time he served as Civil War medical examiner in Rochester, Minnesota.



Figure 2. The Executive Committee of the General Medical Board. Dr. W. J. Mayo served as chairman.

two weekly intervals to provide advice to the Surgeon General, but this became somewhat difficult because a 2-week period was hardly a sufficient tour of duty to be of benefit. As a result, Dr. W. J. Mayo and Dr. C. H. Mayo themselves served this purpose, alternating 1 month at a time so that the other brother could be in Rochester to maintain the Clinic activities.

Among the functions of the Committee on Surgery were to scrutinize the records of the Medical Reserve Corps and to classify the men concerned according to professional and military qualifications and availability for certain appointments in the medical service.

The Medical Board was responsible for the formation of 50 base hospital units to serve the military. A unit at that time was comprised of 27 medical officers, 60 nurses, and 153 enlisted men, which included carpenters, plumbers, technicians, and all personnel and equipment to service a 500-bed hospital. Mayo formed Base Hospital Number 26 under the aegis of the University of Minnesota, a period of time when the Mayo Foundation for Medical Education and Research was being formed as a graduate activity of the University of Minnesota.

In November 1917, there were 200,000 men in the Navy and 800,000 in the Army in training. It was anticipated that 500,000 new troops would be in the next draft. There were 13,000 physicians in the military at that time, and those from Minnesota represented 12.3% of the Minnesota medical community. In addition to the 13,000, 2000 more had applied for commissions. In a year's time, from November 1917 to December 1918, the numbers both in the regular corps and the reserve of both the Navy and the Army increased significantly, especially the Reserve Corps in the Army going from just less than 1000 to over 30,000 officers.

Base Hospital Number 26 was ready in June of 1917 and was mobilized in December of that year. The unit was transferred from Minnesota to Camp Oglethorpe in Georgia for intensive training. In June of 1918, it left for Europe on the S. S. Leviathan with a single escort, the S.S. Adriatic, under the British flag. The unit landed in northern France and began construction along with nine other units present, each developing its own facilities. Hospital 26 was comprised of 53 buildings, 20 for receiving wards, and the rest for support. Wounded were being received before the supplies for the hospital had arrived, and as a result, biscuit tins were used for sinks, tubs, and in the laboratory. Bathing facilities were made from slabs of roofing material, sterilizers were made from empty barrels, refrigeration was from gunny sacks over frames over which water was dripped. During the offensive of the summer of 1918, hundreds of wounded arrived each day. While the hospital was functioning, it treated over 7200 injured. Sixty-three members of the Mayo staff served in Europe during this period of time.

During the earlier part of World War I, the highest rank to which a regular officer in the Army could reach was that of a colonel. If the officer was from the Reserves, major was the highest rank possible. Harvey Cushing, George Crile, Hugh Cabbott, and others went to Europe as majors, at which time they found that their contemporaries from England and France were colonels or generals. The Americans considered their ranks to be of inferior status and resented the humiliation. Restrictions of rank was not true for Naval medical officers. Because of complaints and at the encouragement of Dr. C. H. Mayo, the Secretary of War, Newton D. Baker and President Wilson presented the issue to Congress. Secretary Baker said in testimony:

"I wish to strongly emphasize that without legislation giving the Army equalization of rank and higher grades with that of the Navy which I might say was not restricted to the categories as was the Army, the detrimental effect of which to the Army is too clear, requires more of a statement."¹

The Owens-Drier bill addressing this issue became law permitting the Army to advance medical officers as high as the rank of major general.

Also, at this time, Dr. Will was appointed to an advisory post of the general staff when he reported for duty, he was told "his presence would not be required." This rebuff to medicine was reported in *Military Medicine* and led to a reaction of disgrace toward the general staff, and it became a laughing matter, actually to the extent that the editor of *Military Medicine* had to resign. Dr. Will returned to his position as advisor to the surgeon general for surgical services.

During the time that many of their colleagues were in

Europe, other members of the staff in Rochester, in addition to their clinical duties, were participating in intensive training of military personnel at all levels. Sixty to 70 persons were always in Rochester and these persons were receiving 200 hours of training. Dr. E. Starr Judd was in charge of this program. Interestingly, before the war, medical supplies, and especially technology, was primarily coming from Germany. Because these supplies and services no longer were available, medical personnel, not only at the clinic, but within the entire country, had to improvise substitutes. This led to a medical industry being developed in this country.

Another member of the Mayo staff who contributed greatly to the war effort and to the future of laboratory medicine was Colonel Louis B. Wilson, who served in Europe and was responsible for the establishment of more than 300 medical laboratories in hospitals of the American Expeditionary Forces. His efforts contributed greatly not only to the availability of laboratories, but to the services which they provided. It is said that physicians who served in the military in Europe returned to the United States and when again entering their private practices, demanded the availability of laboratories in the hospital and other medical facilities. Before the war, these services were sadly lacking in this country. Not only was Dr. Wilson a very capable person in laboratory techniques and pathology, but interestingly, he was an expert on ballistic missiles and served as a consultant in this field. In his home, he had a wide selection of various types of guns, with data on the speed of missiles and bullets. Not contributing necessarily to the war effort in his laboratory and in ballistics, he was one of the early pioneers in developing color photography.

When the armistice was signed, Dr. Will cabled greetings to professional friends in Germany and Austria. Secret Service persons immediately appeared at his office and confronted him with the comment that he had tried to "communicate with the enemy". Dr. Will's response was "I thought the war was over." He felt that the hostility of war should not extend to the scientific community. However, it was not until 1926 that German surgeons again entered the American Surgical Association. The delay was because German was not again made an official language.

Dr. Will and Dr. Charlie's contributions to the war effort was recognized in a variety of ways after the armistice. They were both awarded distinguished service medals. Both were promoted to brigadier generals, and in 1934 (Fig. 3), the American Legion recognized them for "distinguished services to our sick and disabled comrades and to suffering humanity." Also in that year, the citation from the U.S. Counsel of National Defense was given to both of them. In 1934, Dr. Will and Dr. Charlie also were awarded a citation by the American Legion.



Figure 3. The Mayo Brothers were promoted to Brigadier Generals after the war. Will is on the right, and Charlie is on the left.

President Franklin Roosevelt came to Rochester to present this. Dr. E. Starr Judd, who was responsible for the military educational activities in Rochester, Dr. Henry Plummer, who served as a consultant to the defense effort, Dr. Balfour, who subsequently became director of the Mayo Foundation and contributed greatly to the military medical effort during World War II, and Dr. Wilson were all recognized by the President.

Surgeons who remained in Rochester and carried the work load during World War I, when the brothers and other associates were absent, included Dr. Stuart Harrington, Dr. James Masson, Dr. William Braasch, Dr. Donald Balfour, Dr. Melvin Henderson, Dr. John Pemberton, as well as Dr. Judd, all stalwarts in the surgical department of the clinic.

During the interim between World Wars I and II, Mayo continued to participate in support of the military activities of the Army and Navy. An Army Medical Reserve Corps was established in the early 1920s, and courses on military medicine began in 1924, with increasing registration at each of the courses. In 1932, the first of two naval medical specialties units was organized, and the second one was organized in 1934. These were developed at the urging and the concurrence of the surgeon general of the Navy.

Dr. Balfour was director of the Mayo Foundation during World War II. Earlier, he was one of the outstanding gastrointestinal surgeons at the Clinic. Dr. Balfour married Dr. Will's elder daughter, Carrie. Dr. Balfour, during World War II, was responsible for the educational experiences for more than 1500 medical officers who were given short courses in Rochester in groups of 75 to 100 serving in varying periods of 3 months, more or less. He served as consultant to the Army and Navy and as a member of the National Research Council.

In 1948, Dr. Balfour received the President's Certifi-

cate of Merit and citations from the Secretaries of War and Navy.

Dr. Thomas Mcgath served as general inspector of the Navy, Dr. Winchell Craig was head of neurosurgery at Walter Reed Hospital, and Dr. Waltman Walters served in a variety of capacities in the Navy. Both Craig and Walters were made admirals, and Dr. Mcgath was made a commodore. Dr. Howard Gray served on the hospital ship *Solace* and was subsequently Chief of Surgery at Aiea Heights in Hawaii.

Under Dr. Balfour's leadership, the first human centrifuge was built to evaluate physiologic changes occurring during blackouts, which were experienced by dive bombing pilots and which were responsible for fatal crashes of many of the planes. In the Mayo Acceleration Laboratory, a standard acceleration time exposure pattern was established and researchers developed an effective straining maneuver (M1) that increased arterial pressure and allowed pilots to maintain momentary acceleration of up to 8 to 9 Gs in a sitting position. This technique, however, did not resolve the problem of blackouts entirely for fighter pilots.

In 1942, Dr. Earl Wood and his associates began developing the antiblackout suit or the G-suit. By 1943, two suits had been made that increased the G-tolerance of subjects in centrifuge studies by as much as 3 Gs. These were the most effective antiblackout suits developed, but the discomfort to pilots prompted the Army services to seek an alternative solution. In 1944, Dr. Wood and his associates developed a simple bladder system that allowed transmission of pressure to specific parts of the body. This system increased blood pressure of centrifuge subjects and thereby increased their G-tolerance. Consequently, the Army and Navy quickly developed versions of this system for their pilots.

Another development at Mayo was the early development of a decompression chamber to study oxygen needs and the effect of high-altitude flying on pilots. This led to the development of the BLB mask, named for its developers, Dr. Walter M. Boothby, Dr. W. Randolph Lovelace II, and Arthur H. Bulbulian. The mask was initially developed as part of Mayo's response to an inquiry from Northwest Airlines. Aviation was then on the brink of a new era in which aviators and passengers would routinely fly at altitudes above 12,000 feet. To ensure controlled atmospheric conditions, Mayo installed in 1939 the first low-pressure chamber in a civilian laboratory in the United States. Dr. Lovelace was assigned to the new facility full time, and he and his associates proceeded to investigate the unknowns of high-altitude physiology. These investigations had their roots in studies of anoxia conducted by Dr. Boothby in 1918 in Mayo's metabolism laboratory. These efforts led to further refinement of the mask, and as the results became known, pilots,



Figure 4. The BLB mask used by pilots during World War II. One million were manufactured.

aircraft designers, and military leaders came to Rochester to learn and often to participate in the studies. The mask proved to be efficient and effective in supplying oxygen for high-altitude flying, so much so, that during the war effort of World War II, more than a million of these masks were manufactured for use by those required to fly at high levels (Fig. 4).

Among those coming to Rochester to test the BLB mask was Charles Lindbergh. Studies were underway on bailing out at high altitudes, and on positive-pressure breathing, both constant and pulsating. Lindbergh, on returning to Michigan (Ford), used this information while working with P-47 pursuit planes.

To test the effectiveness of this automatic demand system mask, Dr. Lovelace made a parachute jump from 40,200 feet and remained conscious and survived the jump without difficulty, although one of his gloves fell off and his hand was severely damaged by the cold—a handicap to any surgeon. Because of the significance of this development, President Roosevelt presented the Collier Trophy, the highest aviation award in the United

States to Boothby, Lovelace, and Bulbulian for the development of this oxygen mask—which certainly saved many lives and permitted pilots to fly much higher than before—for their efforts in promoting aviation safety, with special emphasis on preventing pilot fatigue (Fig. 5).

After the war, Dr. Lovelace was appointed Chief Consultant for the Manned Space Flight Division of the National Aeronautics and Space Administration (NASA). He was responsible for the selection and training of the seven astronauts for Project Mercury. In 1964, President Lyndon Johnson appointed him Director of Space Medicine in the Manned Space Flight Division of NASA.

While research and educational projects were in progress in Rochester, Mayo contributed to the war effort in the Pacific theater.

In 1940, the 71st General Hospital was organized in Rochester, Minnesota, for preparedness before entry of the United States into World War II. Many of its officers and enlisted personnel were recruited from the Mayo Clinic and the Rochester area. In January 1943, the hospital was activated in Charleston, South Carolina. For 6 months, it was a training unit of Stark General Hospital in Charleston. Dr. Charles W. Mayo, a Mayo surgeon and son of Dr. Charlie, was appointed executive officer of the unit. Colonel C. M. Reddig, a member of the regular army, was the commanding officer. He had been with the 89th General Hospital in Charleston. Approximately 550 enlisted personnel were also transferred from the 89th to the 71st General Hospital about that same time.



Figure 5. President Roosevelt presented the Collier Trophy to Boothby, Lovelace, and Bulbulian.



Figure 6. Dr. Charles W. Mayo (right), and Dr. James Priestley as commanding officers of Station Hospital numbers 233 and 237 in New Guinea.

The leadership of the hospital included 12 officers from the permanent staff of Mayo and 21 officers who were fellows in Mayo's graduate medical education program. Two of the leaders were Dr. James T. Priestley, who was appointed chief of the surgical staff, and Dr. Charles K. Maytum, who became chief of the medical service. Many of the nurses had been trained at the nursing schools of the two Mayo-affiliated hospitals. With a total of 662 personnel, the 71st General Hospital was initially formed to care for 1000 patients, but could treat as many as 2000 during emergencies.

On June 24, 1943, the 71st General Hospital was divided, and its personnel were assigned to either the 233rd or the 237th Station Hospital. Popularly known as the "Mayo Units," these new detachments received additional training in Charleston; the 237th spent a brief period in Utica, New York. In January 1944, personnel from both hospital units were transferred overseas, from Camp Stoneman, California, to New Guinea. Members of the 233rd erected a station hospital at Nadzab in the Markham Valley, near the 5th Air Force base, and the 237th built one at Finschhafen, near the New Guinea coast. Dr. Charles W. Mayo and Dr. Priestley were commanding officers (Fig. 6). Both facilities were located in the rain forest, and they experienced the challenges and discomfort associated with almost 200 inches (508 cm) of annual rainfall. On October 15, 1944, the 233rd Station Hospital was redesignated the 247th General Hospital. Along with the 237th, it continued to care for wounded persons in New Guinea until the middle of 1945. Both hospital units were then individually moved to the Philippines. The 247th was established near Clark Field and, the 237th was established at Batangas. The hospitals were in these locations for the rest of the war.

After the units returned to the United States, the surgeon general sent certificates of appreciation to the Mayo Clinic for its contributions in staffing these hospitals.

The staff of Mayo contributed also to the Navy. Two naval units were formed. The first unit was instructed to go around the country and talk to medical personnel on "war medicine and surgery." No member of this unit had war experience, but all represented appropriate specialties of medicine. The unit subsequently joined Unit No. 2 at Corona Naval Hospital in California (formerly a hotel), opening with 6 patients and subsequently having 2000 as the war in the Pacific heated up.

Subsequently, the units were deactivated. Individuals were reassigned to other naval activities, including Guadalcanal in the South Pacific.

Dr. Thomas B. Magath (Commodore) traveled all over the world as general inspector and consultant for Navy Surgeon General Ross T. McIntire; Dr. Craig (Rear Admiral) was ordered to the U.S. Naval Hospital, Bethesda, as Chief of Surgery; Dr. Howard Gray (Captain) served on the hospital ship *Solace* and later was appointed Chief of Surgery at Naval hospitals at Aiea Heights and San Diego; Dr. Snell (Captain) was Chief of Medicine at Oak Knoll; and Dr. Waltman Walters (Admiral) was assigned to duty on Admiral Halsey's staff and later Chief of Surgery at the Naval Hospital in Philadelphia.

Intact medical units in the Navy were considered impractical in contrast to the Army, where compact self-sufficient units were essential.

Other staff members remaining at home served on the National Research Council and in other supporting capacities in the War Effort.

Finally, [I would like to make] a comment regarding the Uniformed Services University Medical School. It is of interest that such a school was proposed by Dr. W. J. Mayo and his associates in 1919. With the war effort over, politicians did not look to the future need, and the effort was not supported. The school was established in 1972 to provide a dedicated corps of medical officers trained in the special medical needs of military conflict. It will be unfortunate if those in the present administration and Congress do not recognize this fact.

Again, my comments reflect contributions of Mayo and in no way depreciates support to the military efforts of other institutions and individuals to medical needs required by our men and women in the Army, Navy, Marines, and Coast Guard.

Reference

1. Walters, Waltman. The doctor Mayo and their military medical activities. *Military Med.* 1965; 130:334.