during a period of peace and tranquillity. A good time to mend the roof is between rainstorms.

Nothing has been said of the recurring and insistent problems of *clinical psychology*, a field of highest practical importance in any fighting force. Military psychologists specializing in this difficult subject are wanted today, not only in neuropsychiatric wards of Army hospitals, but also in the consultation services at training centers, to help in preventing minor maladjustments and forestalling serious mental illness. Their usefulness will increase with the completion of current and projected studies of exceptional behavior in relation to the psychiatrists' diagnoses, treatments, and follow-up.

The systematic study of *attitudes and opinions*, too, is a technical field not to be neglected by an army which aims to keep a finger on the pulse of its personnel. Opinions flow along. You can treat them scientifically or unscientifically. You ignore them at your peril.

Equally essential in war is contact with the mind of the enemy. How best can we monitor and analyze his broadcasts? How should we ascertain the effects of military campaigns or of different patterns of strategic bombardment on the morale of his civilian populations and his troops? What truths of ours, what ways of informing him, are our most potent weapons of *psychological warfare*?

If ever again America should approach the catastrophe of war, answers to these imperative questions of military psychology should already be at hand.

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Obituary

Sir Joseph Barcroft
1872–1947

With the death of Sir Joseph Barcroft on March 21, the School of Physiology at Cambridge, England, lost one of its most distinguished and best-loved members. A student of the founders of the School—Foster, Langley, and Gaskell—Sir Joseph, perhaps more than anyone else, preserved its traditions and, through the host of students and collaborators he attracted, brought those traditions to international recognition.

Joseph Barcroft was born on July 23, 1872, at Newry, County Down, Ireland. He received his early education at Bootham at York and the Leys at Cambridge. After receiving the B.Sc. at London he went to Kings College, Cambridge, in 1893 with an exhibition. There he gained first-class honors in Parts I and II of the natural sciences tripos and was graduated with the B.A. in 1896.

Barcroft then began to study the mechanisms which provide the tissues with oxygen, an aspect of physiology then unexplored at Cambridge and the one which formed his dominant interest during almost half a century of active investigation. The earliest studies were designed to estimate the rate of oxygen utilization by a variety of tissues—the submaxillary gland, the kidney, the pancreas, and the heart in activity and at rest. These, some of which were made alone and others in collaboration, provided the basis for the recognition in quantitative terms of what Barcroft phrased as "the call for oxygen."

With the cumbersome apparatus for the estimations of the blood gases available at the turn of the century, data on gaseous metabolism of tissues were hard earned. Extraction methods were time consuming and required relatively large amounts of blood. To facilitate his estimations, Barcroft devised and improved the differential manometer, an instrument which opened new possibilities for the study of tissue metabolism and one which today, either in its original form or Warburg's modification, is used in biological laboratories throughout the world for the study of the respiratory exchanges of small amounts of tissue as well as for following the reactions of isolated enzyme systems. The invention of the differential manometer opened the way for Barcroft's classical studies on factors affecting the combination of oxygen and hemoglobin, to which his attention was drawn by a desire to estimate the oxygen or pressure in tissues at rest and in activity. For this purpose he sought to use the dissociation curve of the blood, but the variations in the form of the curves he prepared, as well as those of others, led him to investigate the effects of acids and salts on the affinities of hemoglobin for oxygen, a study which laid the foundation for our present knowledge of the role of chemical changes in the blood in the release of oxygen at the tissue capillaries.

From the physiology of hemoglobin, Barcroft turned his attention to a description of the circumstances responsible for the transfer of oxygen from the alveolar spaces into the red cell. Until about 1922, physiologists were divided in their views concerning the role of the pulmonary epithelium. The researches of one school, led by Haldane, appeared to support the view that the epithelium was capable of secreting oxygen into the blood; the other, including Keogh and Barcroft, that the epithelium acted as an inert membrane. The controversy, a classic in its freedom from prejudice and narrowness, was decided in favor of the latter view, by evidence provided in large measure by Barcroft's studies made on himself while he lived for several days in a glass chamber at reduced oxygen pressures, the essential blood samples being drawn from an exposed artery in his forearm.

Interest in the effects of reduced oxygen pressures on the body mechanisms providing oxygen to the tissues were also explored during two expeditions which Barcroft led, the first to Monte Rosa in 1911, and the second to the Peruvian Andes in 1922. Knowledge gained on these expeditions and in the laboratory was used by Barcroft in World Wars I and II to the direct advantage of his country by its application to aviation warfare. It also provided the basis for his interest in blood stores and his search for the source of red cells delivered to the circulating blood as the individual entered environments of decreased oxygen pressure. The classical researches on the spleen and the circumstances under which it stores or delivers red cells are now familiar to all who have an acquaintance with physiology.

Differences in the bloods of fetuses and their mothers and their apparent functional advantages led Barcroft to study the respiratory function of the blood in the fetus. The readiness to follow an interest "beyond the visible horizons," so characteristic of the man, served to develop the whole field of fetal physiology, including the functions of the placenta, the circulatory changes at birth, and the functional development of the nervous system. The results of his researches and those of his collaborators in this field—a field which some claim Barcroft established in its own right—are summarized in *Researches on prenatal life*, which appeared late last year.

All of these investigations were based upon simple ideas and questions and carried through with direct methods and simple techniques. They were not designed to gather details except in so far as they were essential for the development of method in technique; they were designed to reveal principles of function or integrations. Once these were at hand, Barcroft moved on to expand his chosen field of interest, leaving the intricacies to be explored by those with special knowledge.

The record of Barcroft's investigations has been said to be one of the most fascinating in the annals of science, for few investigators have revealed so much of themselves in their writings. His freedom from all that was artificial in life, his charity and warmheartedness, are nowhere better revealed than in the first edition of *The respiratory function of the blood*. Anyone who opens its pages joins him in the high adventure of investigation, for there the pitfalls and pleasures of research are presented in a fashion which has encouraged and will continue to encourage young men to find in the pursuit of science a worthy purpose in life. There are revealed the personal qualities which enabled Barcroft—and Michael Foster before him—to attract young men with special talents and to direct their attention toward problems they were peculiarly fitted to solve. His flare for presenting a problem simply and his readiness to encourage and assist young men to careers in physiology and the allied sciences drew to him a host of students and collaborators.

In the years following his student days and before World War I, when he served as demonstrator and then lecturer in the University, few students entered the Cambridge laboratory who did not work with him at some time during their stay. After the War and until he retired from the Chair of Physiology (which he held from 1926 to 1937, succeeding Langley), students came to his laboratory from all over the world, many of them from the United States. Through his pupils and collaborators from this country, his Dunham Lectures given at Harvard in 1929, and the Terry Lectures at Yale in 1926, Barcroft made a special contribution to the development of physiology here. This, together with his achievements as an investigator, was recognized by his election as a foreign associate of the National Academy of Sciences in 1939.

Many other honors came to Sir Joseph. He was elected to the Royal Society in 1910 and was awarded a Royal Medal in 1922 and the Copley Medal in 1943. He was knighted in 1935. Although he retired in 1937, his years of service to science were not at an end. His broad biological interests and his talents as an administrator were utilized during World War II, when he served on advisory committees of the War Office and the Royal Air Force. To the establishment of the Nutrition Society he gave his unfailing devotion and served as its chairman from 1945 until his death. When the Agricultural Research Council elected to promote fundamental research on the large, domesticated animals by the establishment of a Unit of Animal Physiology at Cambridge, Sir Joseph was chosen as its director. In this post, with undiminished vigor, Barcroft continued to look and "to venture beyond the visible horizon," his craft in full sail to the end, for he died en route to his home for luncheon after a full morning in the laboratory.

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