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The Charles R. Drew Papers
Becoming "the Father of the Blood Bank," 1938–1941

In 1938, Allen O. Whipple's surgical residency program at the Presbyterian Hospital in New York, the main teaching hospital for Columbia University's College of Physicians and Surgeons, was one of the most advanced in America. It extended surgical residencies to three years, the last two of which gave residents experience in surgical pathology and bacteriology, surgical laboratory research, and the outpatient clinic, in addition to the operating rooms and surgical wards. After passing their surgical board exams, the two best residents served an additional year in the hospital, honing their skills even further. The program thus turned out surgeons familiar with all aspects of surgical science and therapy, and gave them opportunities to pursue research in individual fields. (An added benefit to having such experienced residents was that Presbyterian's surgical mortality rates were impressively low.) However, though the hospital was committed to serving the poor regardless of race, African American physicians had never been granted residencies or staff privileges there. Thus, when Charles Drew arrived with his dual goals of gaining more surgical training and earning a doctorate in medical science, Whipple assigned him to John Scudder's surgical lab, assuming that he would spend his fellowship there and not attend patients. But Drew, with his soft-spoken charm and obvious brilliance, persuaded Whipple to train him as a resident, and won over his fellow residents and the hospital staff as well. (As one of his Columbia colleagues later noted, it probably helped that Drew was very light-skinned; a more conspicuously African American physician, regardless of competence or charm, might not have had the chance to attend patients with Whipple.) Whipple soon became one of Drew's strongest allies, supporting both his surgical training and his doctoral research.

In Scudder's lab, Drew again pursued research into fluid balance, diagnosis and control of shock, and transfusion. Scudder believed that certain aspects of blood chemistry, such as specific gravity and protein content, could indicate the beginning of shock earlier than blood pressure readings, and possibly help differentiate between hemorrhagic and other forms of shock. Drew helped develop blood tests to diagnose early shock, and published several articles with Scudder on these studies.

Much of Drew's research, however, focused on one of the most challenging medical problems of that time: how to "bank" blood so it would be available for transfusions as needed. Blood loses its integrity--and thus its utility--soon after it leaves the blood vessels: it starts to clot, and soon the cellular elements, especially the white blood cells, deteriorate, and levels of electrolytes change. Before World War I several researchers had discovered that sodium citrate would keep the blood from clotting, and that dextrose would preserve it for up to two weeks under refrigeration. One WWI medical officer, Oswald Robertson, set up a temporary small-scale blood bank and did twenty-two successful transfusions with stored blood. During the inter-war period, researchers in America and abroad studied blood's properties to better understand how it changed under various storage conditions and how such changes affected transfusion outcomes. At the same time, clinicians at some large urban hospitals were

establishing transfusion donor services, registering donors who could be called in quickly when transfusions were needed. In 1929, New York's leading hospitals, surgeons, and blood researchers founded the Blood Transfusion Betterment Association (BTBA) to provide the local medical community with reliable, thoroughly tested donors on demand, and to provide financial support to blood researchers. Only a few of these programs stored the collected blood for later use; the first opened at Chicago's Cook County Hospital in 1937; its director, Bernard Fantus, coined the term "blood bank." (Although many American researchers were unaware of it, Soviet physicians had established a large blood donation network, and had experimented successfully with transfusing stored cadaver blood.) These programs varied in their staffing arrangements, facilities, equipment and lab protocols, donor recruitment, and other aspects, however--there was still no standardized procedure for collecting blood, preserving it from contamination and deterioration, and protecting transfusion recipients.

For his doctoral research, Drew set out to assess the blood and transfusion research to date, and to apply his findings to a trial blood bank program. He reviewed the history of blood transfusion as well as all the current research on blood chemistry and fluid replacement, including the Soviet investigations. He then evaluated all the variables that might affect the shelf life of stored blood: how it was collected (in open or closed vessels, or under a vacuum), what types and amounts of anti-coagulants and preservatives were used, the shape of the storage containers, storage temperatures, and so on. He also queried the directors of six leading transfusion clinics about their procedures and experiences. In August 1939, he and Scudder obtained funding and authorization to set up an experimental blood bank at Presbyterian Hospital to work out the organization and best collection protocols for such an operation.

Medicine now takes blood banks for granted, but the first ones presented many technical and administrative challenges to Drew and Scudder and their colleagues: blood had to be collected with sterile equipment, into sterile containers, and treated with anticoagulant, then stored at a constant temperature, in refrigerators that were reliably efficient and protected from electrical outages. Each donation had to be typed, and tested for syphilis (one of several diseases that could be transmitted via transfusion.) Donors had to be recruited, scheduled, and screened for obvious health problems before "bleeding." Nursing and laboratory personnel had to be trained in collecting, handling, and testing the blood, and standard procedures set up, including forms to track every step of the donation process. Their experiment, which ran for seven months, was a success, and served as the basis for Drew's dissertation, "Banked Blood," for which he received his doctor of medical science degree in June 1940.

In the meantime, World War II had begun in Europe with Hitler's invasion of Poland in September 1939. American leaders hoped to stay out of the conflict, but started assessing the nation's readiness for war, including its medical and scientific resources. As part of this effort, the National Research Council (NRC) appointed a Committee on Transfusion (which included many leading clinicians and researchers, such as Scudder) in May 1940 to evaluate the status of blood supplies. By mid-June, the Netherlands, Belgium, and France had fallen to German

forces, and the British had been forced into retreat. As Germany began the sustained bombing of England that summer, the British were in desperate need of medical supplies, including blood and plasma for transfusion. In response, members of the BTBA met with representatives from the NRC and the American Red Cross to organize a relief program--Blood for Britain--to collect blood donations at area hospitals and ship blood plasma to England. Besides providing vital short-term aid to England, Blood for Britain was intended to gather the research and administrative data and experience needed to launch a nationwide blood banking program if the U.S. entered the war.

Plasma--the fluid portion of blood, containing various proteins and electrolytes but no cells--had been investigated as a blood substitute by several research teams, including Drew and Scudder, during the 1930s. Although it lacks oxygen-carrying red cells, it worked well to replace fluids and treat shock. And, especially for emergency or combat situations, it had advantages over whole blood: it keeps longer without refrigeration; it won't deteriorate when agitated during transport; it can be used with any blood type; it is much less likely to transmit diseases; it can be given intravenously, intramuscularly, or subcutaneously, and in large doses. And several labs were working on methods to dry plasma, which would make it even easier to transport and use. Drew worked with Scudder and E. H. L. Corwin to draw up a blueprint for Blood for Britain. Their blood bank at Presbyterian served as an organizational template, but had to be scaled up enormously to collect, process, and store large amounts of plasma at six (later nine) different hospitals. Besides the basic blood bank operation, they had to set up procedures for extracting plasma and ensuring that it would still be uncontaminated and safe to use when it arrived in Britain. Plasma was separated from the blood cells by centrifuging or sedimentation, then the plasma from an average of eight collection bottles was pooled (using an aseptic procedure in a dust-proof, air-conditioned, ultraviolet-lighted room, under a lab hood), and a sample cultured for bacteria; merthiolate (an anti-bacterial) was added, and the batch tested again after a week. Finally, each batch was transferred to a shipping container (again using aseptic methods) and diluted with sterile saline solution. A final sample for bacteria testing was taken before the containers were sealed and packed. Despite its size and complexity, the project was set up quickly, and a trial shipment of plasma was sent to England in early August. The British reported that it was "entirely satisfactory" and the program opened officially on August 16.

Soon after drafting the Blood for Britain blueprint, in June 1940, Drew had returned to his faculty post at Howard University. During the initial weeks of the program, however, it became clear that tighter coordination of the participating hospital operations was needed. The BTBA called Drew back to New York in September to serve as the full-time medical supervisor. Under his direction, the collection procedures, equipment, and record-keeping were standardized. He also improved the quality-control provisions, including designating a central laboratory at Presbyterian Hospital to perform the final bacteriological check on batches of plasma. Although Drew didn't "discover" plasma as a blood substitute, his expertise and leadership were largely responsible for the program's success. When it concluded in January 1941, Blood for Britain had collected 14,556 blood donations, and shipped (via the Red Cross)

over 5,000 liters of plasma saline solution to England. Drew's final report on the project, issued by the BTBA in January 1941, established him as a leading expert on blood procurement and processing. An in-house Red Cross history noted that Drew's report "had brought together, for the benefit of hematologists working everywhere, the latest knowledge acquired by scientists working in several different fields." It was a remarkable synthesis of research studies (both commercial and academic), clinical tests, and the practical experience gained from blood bank operations here and abroad.

Just as he had used the Presbyterian blood bank as a template for Blood for Britain, Drew now used the latter program as a model for a three-month Red Cross pilot program to mass-produce dried plasma in New York. In February 1941, he became assistant director for this pilot program, which in turn became the model for the National Blood Donor Service. During this trial, Drew introduced the use of mobile collection units (later called "bloodmobiles.") By the time he returned to Howard in April 1941, Drew's reputation as a blood plasma pioneer and "father of the blood bank" was growing. Drew never claimed these titles himself, despite his substantial contributions, always noting that it took the combined efforts of many people to make the massive wartime project succeed.

Ironically--considering the essential part that an African American played in its success--the national blood collection project was sullied by racism from the start. Blood donations and plasma for Blood for Britain had been segregated, on the assumption that the British would prefer this. The Red Cross pilot project, at the insistence of the armed forces, excluded black donors. This policy was maintained when the National Blood Donor Service officially began in November 1941, provoking protest from the black press and the NAACP, among others. In January 1942, the Red Cross announced that it would accept blood from black donors, but would segregate it. Drew, of course, objected to this policy--there was no scientific evidence, he said, of any difference between blood of different races, and the policy was insulting to African Americans, who were just as eager to contribute to the war effort as anyone else. He wrote and spoke about this frequently during the war years; as he noted in his Spingarn Medal acceptance speech in 1944, "It is fundamentally wrong for any great nation to willfully discriminate against such a large group of its people. . . . One can say quite truthfully that on the battlefields nobody is very interested in where the plasma comes from when they are hurt. . . . It is unfortunate that such a worthwhile and scientific bit of work should have been hampered by such stupidity."

There is no evidence, however, that this blood exclusion policy was Drew's reason for leaving the pilot program and not continuing on to direct the national project, as some accounts suggest. As absorbing as the blood banking projects had been for him, he had been apart from his wife and their first child (Bebe, named for the *B*lood *B*ank) for much of the previous year, and was eager to return home. Moreover, he had always expected to return to his faculty duties at Howard and pursue his long-range plan to establish a first-rate surgical program there.

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"Becoming 'the Father of the Blood Bank,' 1938–1941" in *Profiles in Science: The Charles R. Drew Papers.* http://profiles.nlm.nih.gov/ps/retrieve/Narrative/BG/p-nid/336
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