Laudatio: Dr. Belding H. Scribner

Belding Hibbard Scribner, MD, was the recipient of this year's Special Award for Lifetime Achievements in Hemodialysis. The award was presented during the General Session of the 22nd Annual Dialysis Conference, in Tampa, Florida, March 4, 2002 (Fig. 1). Dr. Scribner is the father of hemodialysis treatment for chronic renal failure.

Dr. Scribner was born on January 18, 1921, in Chicago, Illinois. He spent his early youth in Chicago but, because of allergies, he spent ragweed season in Wisconsin to avoid asthma attacks. His ancestors on his mother's side lived in Belding, Michigan, a small town near Grand Rapids. His mother's maiden name was Belding; hence his first name, which Scribner never liked, preferring to be called "Scrib" by his collaborators. Because of his asthma, he always thought of going to medical school. He attended Williams College in Williamstown, Massachusetts, in 1937 and 1938, where, during chemistry lessons, he had a chance to observe the power of osmotic force. His chemistry teacher showed an experiment performed on the stairs in the chemistry building, where he put copper sulfate solution into a long tube closed at one end by a semipermeable membrane and submerged the membrane in water. The osmotic force pushed the copper sulfate solution up three stories. Scribner next attended the University of California Berkeley, from 1938 to 1941, where he received a Bachelor of Arts degree. A microchemistry course at Berkeley turned out to be very helpful in his later development of bedside tests for serum electrolytes [1].

FIGURE 1 Dr. Scribner could not come to Tampa, so his long-term collaborator and friend, Dr. Christopher R. Blagg, accepts the award plaque from Dr. Twardowski.

In 1941, Scribner entered Stanford University School of Medicine in San Francisco. Before graduation, he completed 1 year of internship at the San Francisco Hospital, and he received his MD degree in 1945. His mentor in medical school was Thomas Addis, a Scotsman, who had studied in Edinburgh, Scotland, and Heidelberg, Germany. In 1911, Dr. Addis was invited to Stanford University's School of Medicine in San Francisco, and in 1920 was appointed Professor of Medicine. Addis is famous for his Addis counts in urine and for his studies on the "urea ratio," which led him to the concept of clearance (the amount of blood "freed" from urea per unit time), and so to the birth of modern renal physiology [2]. In the 1940s, Addis was interested in water and electrolyte problems and involved his protégé in this area. Under his direction, Scribner worked on a bedside chloride test to diagnose saline depletion, and developed bedside tests for serum bicarbonate, total base, and urea. These studies gave him excellent background knowledge in fluid and electrolyte balance and the skills to measure electrolytes at the bedside. In later years, these would become the basis for the *Fluid and Electrolyte Syllabus*, with which thousands of University of Washington medical students were taught a simple and effective way to manage fluid and electrolyte balance.

Dr. Scribner completed his residency program at San Francisco Hospital in 1947 and moved to Rochester, Minnesota, for a fellowship at the Mayo Foundation. His first two published papers dealt with fluid and electrolyte problems [3,4]. One sunny afternoon in July 1950, his interest was redirected to a new frontier in the treatment of renal failure. On that day, in the Mayo Foundation House, he heard Dr. John P. Merrill's talk on the Brigham version of the Kolff rotating-drum artificial kidney. Scribner recalls, "Merrill's talk convinced me that hemodialysis had a real future, both as therapy and as a research tool to manipulate electrolyte balance" [5]. Unfortunately, the Mayo Clinic did not share his enthusiasm. After he finished his fellowship in 1950, he stayed one more year at the Mayo Clinic as Assistant to Staff and achieved a Master of Science degree from the University of Minnesota in 1951.

Dr. Scribner moved to the Veterans Administration (VA) Hospital in Seattle, Washington, where he held the positions of Associate in Medicine, then Instructor in Medicine, and Director of General Medical Research from 1951 to 1957.

There he was able to convince the VA research program to acquire an artificial kidney. After visiting several centers in 1953, he decided to choose the Skeggs/Leonards hemodialyzer over the rotating drum because of the smaller blood volume contained in the kidney and because it used hydrostatic rather than osmotic ultrafiltration [5]. Another important feature of this hemodialyzer was the low internal resistance of the blood path so that the blood pressure in the arterial cannula could provide sufficient flow without the use of a blood pump [5].

From 1954 to 1958, Scribner held the position of Assistant Professor at the University of Washington in Seattle. In 1958, he became an Associate Professor and Head of the Division of Nephrology, and in 1962 he was promoted to the rank of Professor of Medicine (Fig. 2). In the late 1950s, he developed Seattle's first artificial kidney program for the treatment of acute renal failure. As head of the Division of Nephrology, Dr. Scribner gradually established a strong team within the division and close cooperation with various departments of the University of Washington.

When, in 1959, Paul E. Teschan introduced "prophylactic daily dialysis" for the treatment of acute renal failure [6], Scribner developed a continuous dialysis technique in an attempt to improve the results using the Skeggs/Leonards hemodialyzer and arteriovenous Teflon shunt. Although the McNeill–Collins dialyzer used by Teschan had low internal resistance and low containment volume, the clotting problems and low efficiency inclined the Seattle group to continue to use the Skeggs/Leonards dialyzer [5]. A large Sears Roebuck deep freeze served as a reservoir of cold dialysis solution that could be used for 12 – 24 hours of dialysis. This method of continuous-flow hemodialysis, which was presented during the Chicago meeting of the American Society for Artificial Internal Organs (ASAIO) in 1960 [7], was resurrected in the mid 1980s [8].

FIGURE 2 Dr. Scribner in the 1960s.

In March 1960, a new chapter in the treatment of chronic renal failure was opened. Wayne Quinton, an engineer working in the University Hospital medical instrument shop, had developed dialysis cannulas for Scribner using Teflon tubing. Some years previously, in Sweden, Dr. Nils Alwall had used rubber and glass tubing in an attempt to keep dialysis cannulas open between treatments, but the shunts clotted within a few hours. Teflon shunts stayed opened for days [9] and, again, the pressure in the arterial cannula was sufficient to propel blood through the dialyzer without the use of a pump. On March 9, 1960, Dr. David Dillard, a pediatric heart surgeon, implanted the first Teflon shunt into the forearm of Clyde Shields, a Boeing machinist, who was admitted to Scribner's service with severe uremia from chronic renal failure. His BUN was 120 mg/dL, serum creatinine was 20 mg/dL; he had a clouded sensorium and uremic twitching, and was vomiting. Using the technique of continuous dialysis, as developed for the treatment of acute renal failure, Clyde was dialyzed for 76 hours. The results were spectacular. He became ambulatory for the first time in weeks, stopped vomiting, and felt generally well for several days. With a second hemodialysis treatment, begun on March 21, he became the first chronic intermittent hemodialysis patient in Seattle. On March 23, a second patient, Harvey Gentry, also started intermittent hemodialysis. A report on the treatment of these 2 patients was published in that year's *Transactions of the American Society for Artificial Internal Organs* [10], in spite of the fact that the paper was not presented formally at the meeting in Chicago. Instead, one evening, Clyde Shields and his wife, Emmie, met informally with some of those interested in hemodialysis, and the results so far and the technique for making the Teflon shunt were presented informally in a hotel bedroom. Because of the potential importance of this development, Dr. George Schreiner, then Editor of the *Transactions*, decided to publish the paper despite the rule that every paper in the *Transactions* had to have been presented at the meeting [1].

Two more patients were started on hemodialysis in the next 3 months. Initially, dialysis sessions were performed every 7 to 14 days for 24 to 48 hours, but soon the frequency of dialysis was increased so that dialyses were performed for 24 hours every 5 to 7 days using Skeggs/Leonards dialyzers. Experience with these first 4 patients was presented at the 1961 meeting of the ASAIO [11]. All 4 patients had survived in spite of multiple problems, including hypertension, vomiting, lethargy, hyperkalemia before dialysis, hypotension after dialysis, neuropathy, gouty attacks, and severe anemia. Continuous diligent observation of the patients and improvements in the equipment and technique led to continued improvement in the patients' conditions and explained the observed complications.

Each consecutive presentation and publication revealed important improvements in therapy. Teflon, which, because of the nonstick properties, prevented clotting, proved to be so stiff that the rigid cannula tip damaged the intima of the blood vessels every time the patient moved his arm. Quinton solved this problem by replacing part of the cannula with flexible, smooth, hydrophobic, silicone rubber tubing to act as a shock absorber [12]. In 1961, Scribner brought home a four-layer Kiil dialyzer from Copenhagen. This device, originally designed as a blood oxygenator, was a flat plate dialyzer similar to the Skeggs/Leonards dialyzer, but very well manufactured, easier to assemble, and more reliable [5]. It proved so successful that Scribner convinced Martin Headman, Director of Research at the Western Gear Corporation in Los Angeles, to manufacture Kiil boards. This company, which had no real interest in medical devices, supplied Kiil boards at cost for many years [5].

Four more patients were started on hemodialysis in Seattle in 1961, and the results were presented during the Eighth Annual Meeting of the ASAIO, held in 1962 [13]. The patients had received the new silicone–Teflon cannulas, Skeggs/Leonards dialyzers had been replaced by Kiil dialyzers, and dialysis frequency had been increased to twice weekly in those patients that had lost residual renal function. Neuropathy was improved with more frequent dialysis, and the role of the calcium phosphate product in metastatic calcifications and pseudo-gouty attacks was recognized. Only 1 patient died during the first 2 years of the Seattle chronic dialysis program. The basis for success was careful observation, attention to details, and complete devotion to both the patients and the program. Initially, others had difficulty emulating the results achieved by Scribner and his group [14].

For the next several years, most of the improvements in chronic dialysis therapy were made in Seattle, which became the mecca for all who wanted to study dialysis. Many departments at the University of Washington collaborated with the Division of Nephrology, and the atmosphere of cooperation, progress, and inventiveness was so prevalent that even patients participated in the research. During the Eighth Annual Meeting of the ASAIO, Dr. James R. Albers, a physicist and the fifth chronic hemodialysis patient, presented a paper on the frequency of changing the dialysis bath to obtain optimal results [15]. The audience did not realize that the presenter was himself a patient, and most of them could not comprehend the complex mathematical approach he suggested [16].

By mid 1961, Scribner felt there had been enough technical progress with dialysis to warrant development of a community-supported program to provide a service-oriented artificial kidney center as a public service. He approached the President of the King County Medical Society, Dr. James Haviland, for assistance in developing such a center. Because of their efforts, the King County Medical Society and the Seattle Area Hospital Council agreed to help develop the center, and funding support was obtained from the John A. Hartford Foundation. To reduce costs, it was decided to put the center in the basement of Swedish Hospital's nurses' residence, where a three-station unit was constructed. This opened in January 1962 as the non-profit, community-supported, Seattle Artificial Kidney Center, the world's first freestanding dialysis center [17].

Estimates of the number of suitable patients at that time were 5 to 20 new patients per million population per year and, as this was obviously beyond the capacity of the center, a selection process was essential. This led to the appointment, by the King County Medical Society, of an anonymous Admissions and Advisory Committee for the center, composed of two physicians not involved in the care of dialysis patients, a lawyer, a housewife, a businessman, a labor leader, and a minister [18]. Very strict medical criteria were used by a committee of nephrologists to screen potential candidates for dialysis. Patients were then presented to the Committee, which made the final decision on acceptance of patients to the center based on criteria such as being a stable, emotionally mature, responsible citizen, and residing in the Northwest, and having available funds, value to the community, potential for rehabilitation, and psychological and psychiatric compatibility [19]. The Committee was dubbed the "Seattle Life and Death Committee" by Shana Alexander in an article in Life Magazine in 1962 [20]. Some have regarded this committee as the seminal event in the development of bioethics as a practical discipline. The ethical issues were addressed by Scribner in his brilliant Presidential Address to the ASAIO in 1964 [21]. The committee continued in operation until 1971. By that time a policy of treating all patients by home hemodialysis, together with support from the State of Washington and public fundraising, was sufficient that all patients regarded as medically suitable for dialysis could be treated by the Center. Within another 2 years, on July 1, 1973, Congress passed the bill providing Medicare coverage for these treatments; almost all patients with end-stage renal disease in the United States became eligible for dialysis or transplantation. Scribner was one of the most important individuals instrumental in convincing Congress to pass the bill.

Dr. Albert L. Babb, Professor of Nuclear Engineering at the University of Washington developed the first proportioning system that prepared dialysate from purified water and concentrate, and that could be used to supply a number of hemodialyzers simultaneously. The prototype, much larger than necessary because the components were "borrowed" from various student projects, was dubbed "The Monster" by Clyde Shields [5]. Because bicarbonate precipitates if calcium and magnesium are present in the same concentrate, the original design used three pumps, one for sodium bicarbonate, one for other salts, and the third for water [22]. However, Charles Mion, a visiting fellow from Montpellier, France, found that acetate could be substituted for bicarbonate and so the equipment was redesigned to use only two pumps [23]. An additional advantage of acetate concentrate over bicarbonate was that acetate concentrate is self-sterilizing, whereas bicarbonate concentrate is not. Although acetate later turned out to be inappropriate for use with very high-efficiency dialyzers, it served well for almost two decades and facilitated the development of many dialysis units.

In 1962, Scribner decided to expand treatment options to include peritoneal dialysis. At that time, Fred Boen, in the Netherlands, published his classic thesis on peritoneal dialysis [24] and, impressed by this, Scribner invited him to work in Seattle. Shortly thereafter, a peritoneal dialysis program was started at the University of Washington; in 1963, the first Seattle patients were started on outpatient intermittent peritoneal dialysis. After years on peritoneal dialysis, one of these early patients received a kidney transplant [16]. A few years later, Dr. Henry Tenckhoff developed a chronic peritoneal catheter [25], which facilitated access to the peritoneal cavity and remains widely used today.

The next major advance was home hemodialysis. In 1964, a 16-year-old high school student was dying of terminal uremia, and at that time the strict acceptance criteria of the Seattle Artificial Kidney Center excluded patients under the age of 18. She and her parents were highly motivated to do everything possible to save her life and, fortuitously, her father knew Babb. The Monster had just been completed, so Babb and his colleagues undertook a crash program to develop a smaller one-person version of the Monster — the Mini-Monster or “Mini” — for home use [5]. On April 5, 1964, the patient was started on hemodialysis, and she and her parents were trained to operate the artificial kidney machine in a room in the University Hospital. Within a few months, the patient was being dialyzed at home in the basement, without medical supervision [26]. The Seattle home dialysis program proved to be very successful, and for several years the University of Washington operated a Remote Home Dialysis Program serving patients from the Northwest and elsewhere in the United States and from abroad [27].

Because of the continuing shortage of financial support for the Seattle Artificial Kidney Center, the Board of Trustees decided in 1966 that, from then onwards, home hemodialysis would be the only treatment option offered to patients. As a result, by the late 1960s more than 90% of the Center’s patients were successfully treated at home [28]. Because assembly of the Kiil dialyzer was a real burden to patients and their families, the Seattle group developed a technique for storage and reuse of dialyzers [29]. With this technique, patients would rebuild their dialyzers only once every 2 weeks instead of for each treatment.

By the late 1960s, most of the basic technical problems had been solved. The results with arteriovenous shunts were good, and some patients kept the same shunt for many years [16]. Even so, blood access was markedly simplified with development of the arteriovenous fistula in 1966. Home hemodialysis was expanding; patients living far from Seattle were being trained and followed with the cooperation of local physicians [30]. The most important question became the amount of dialysis necessary to eradicate the symptoms of uremia and to give the greatest opportunity for rehabilitation. Scribner, an astute clinician, made several extremely important observations. First, he observed that patients with residual renal function were not likely to develop uremic symptoms, including peripheral neuropathy, which was common in anuric patients. Second, it became clear that twice-weekly dialyses were not sufficient to arrest the progression of peripheral neuropathy in patients without residual renal function, and so three times weekly dialysis became routine in the later 1960s [5,16]. Third, Dr. Scribner noted that early patients on chronic peritoneal dialysis did not develop neuropathy, despite poor small molecule clearance. This observation led to the conclusion that the peritoneum was clearing some neurotoxins more efficiently than the small-pore membranes of the early hemodialyzers [31].

Because peripheral neuropathy was the uremic symptom most difficult to eradicate, adequacy of dialysis was defined as that amount that was necessary to prevent this complication. Peripheral neuropathy became rare when patients were dialyzed three times per week for 24 to 27 hours weekly on standard Kiil dialyzers. Based on these observations, Scribner and Babb conceived the idea that the responsible toxins were bigger than small molecules such as urea and creatinine, but smaller than protein molecules, so they called them “middle molecules” (MM). Removal of these MM depends on membrane porosity, membrane surface area, and duration of dialysis. This hypothesis led to the “square meter-hour hypothesis,” which implied that, by doubling the surface area of a hemodialyzer, the time of dialysis could be halved for an equivalent MM removal [32]. Ultimately, the Seattle group developed the first quantitative description of adequacy of dialysis, the “ dialysis index.” This index took into account residual renal creatinine clearance, body surface area, weekly dialysis time, and dialyzer MM clearance. This concept was presented at the Conference on Adequacy of Dialysis, Monterey, California, March 20–22, 1974 [33]. At the same conference, Scribner presented a comprehensive approach to the adequacy of dialysis that included both patient and dialysis-system variables [34]. Patient variables included lean body mass, basal metabolic rate, activity level, residual renal function, diet, lifestyle, access problems, and intercurrent illness. Dialyzer-system variables included surface area, membrane characteristics, dialysis time, ultrafiltration requirements, dialysis frequency, and blood flow.

In the early 1970s, Scribner also turned his interest to developing an “artificial gut,” as he originally called parenteral nutrition. Although parenteral nutrition had been in use since the early 1940s, blood access problems prevented its widespread application. The Seattle group initially used the arteriovenous shunt to administer nutrients [35], but this turned out to be unsuitable because of poor veins and the normal clotting mechanisms in patients without renal failure. Arteriovenous fistulas also clotted easily. Consequently, Scribner’s group began to use a silicone rubber, tunneled catheter inserted into the right atrium [36]. They also developed a portable infusion system that facilitated patient mobility during infusions, as well as allowing for patient travel [37]. This single-lumen intravenous catheter was later modified for hemodialysis in children [38].

Production of dialysate with an acetate buffer, introduced in the early 1960s in Seattle, served well for more than 10 years until disposable high efficiency dialyzers were introduced into practice. It was noted that patients poorly tolerated ultrafiltration during short dialyses with large surface area, high-efficiency dialyzers. Tolerance increased when bicarbonate buffer rather than acetate buffer was used in the concentrate [39]. Further studies showed that patients became acidotic during dialysis and alkalotic after dialysis because the metabolism of acetate is slower than its delivery during high-efficiency dialysis [40].

For more than 35 years, Scrib has lived on Portage Bay on a small houseboat. He used to paddle his canoe (Fig. 3) to and from the University of Washington every day. His wife, Ethel, said, "The only time he won't take his canoe, is when the winds are very strong. Rain or fog does not stop him at all." Later, he replaced his canoe with a motorboat to move around the bay (Fig. 4). Scrib is known around the world for the famous red hat that he wears because of photosensitivity following his four corneal transplants. He decided to wear a red hat because, as he says, "it seemed appropriate to wear something a bit different" (Fig. 5).

Scribner retired as Head of the Division of Nephrology in 1986 and became Emeritus Professor in 1992. He has never stopped working (Fig. 6). His major medical interests in recent years have been adequacy of hemodialysis, dialysis duration and frequency, and blood pressure control [41–44]. Early experience with Clyde Shields, the first chronic hemodialysis patient, who developed malignant hypertension due to volume overload shortly after hemodialysis was started, and the spectacular response of his hypertension to prolonged ultrafiltration and normalization of body water, convinced Scribner that hypertension in hemodialysis patients can be controlled with ultrafiltration. This was the case in Seattle with the long, slow ultrafiltration in the early patients. Scribner

FIGURE 3 Scrib paddling his canoe home from work in 1974. The University of Washington is in the background.

FIGURE 4 Scrib and his wife, Ethel, departing in a motorboat for a meeting.

FIGURE 5 Scrib in his famous red hat. Picture taken by Dr. Eli Friedman in Brooklyn in 1980.

FIGURE 6 Scrib at work on his houseboat in December 2001.

is now crusading to reverse the trend of short dialysis, which is associated with intradialytic hypotensive episodes, difficulty in assessing dry body weight, and poor blood pressure control [43]. Dr. Bernard Charra, Tassin, France, a former fellow of Dr. Scribner, continues to use slow dialysis with gentle ultrafiltration, achieving excellent blood pressure control without blood pressure medications in most patients [45]. In his most recent publication, Scribner and Oreopoulos introduced a new index of adequacy of hemodialysis: the Hemodialysis Product (HDP) [42]. The HDP is the product of dialysis duration in hours multiplied by the square of dialysis frequency per week. Although the index does not take into account body size, residual renal function, or efficiency of small molecule removal, it emphasizes the most important elements of good dialysis: dialysis duration and frequency.

It is worth stressing again that these accomplishments would not be possible without the unmatched atmosphere of cooperation, inventiveness, careful clinical observation, and meticulous attention to detail created by Scribner and shared by all associated with dialysis in Seattle. During his tenure as Head of the Division of Nephrology, nephrologists from all over the world came to Seattle to learn his methods of dialysis that provided unsurpassed results.

Here is a partial list of faculty, fellows, and visitors who have worked in or visited Seattle:

- Faculty (major interest): Suhail Ahmad (chronic hemodialysis), Christopher Blagg (home hemodialysis), Fred Boen (peritoneal dialysis), James Burnell (potassium metabolism), Robert Davidson (hypertension), Joseph Eschbach (anemia), Robert Hickman (chronic renal failure in children, intravenous catheters), Donald Sherrard (osteodystrophy), Gary Striker (renal pathology), Henry Tenckhoff (peritoneal dialysis, peritoneal catheter).
- Fellows (country): Larry Agadoa (U.S.A.), Robert Atkins (Australia), Alfred Blumberg (Switzerland), Jack Broviac (U.S.A.), John E.Z. Caner (U.S.A.), Bernard Charra (France), John D. DePalma (U.S.A.), Kiyohiko Dohi (Japan), Stanley Fenton (Canada), Ulrich Graefe (Germany), Robert M. Hegstrom (U.S.A.), Armando Lindner (Argentina), Charles Mion (France), Robert Popovich (U.S.A.; fellow with Scribner and Babb), Claver Ramos (the Philippines; head of the personal dialysis secret center of Ferdinand Marcos), Miguel Riella (Brazil), Craig Tisher (U.S.A.).
- A few of the visitors (country): Jonas Bergström (Sweden), Carl Gottschalk (U.S.A.), Jean Hamburger (France), Jerry Kassirer (U.S.A.), Guy Laurent (France), Dimitrios G. Oreopoulos (Canada), Jim Robson (Scotland), Bill Schwartz (U.S.A.), Stanley Shaldon (England), Jules Traeger (France).

Chief dialysis technicians, James J. Cole and Joseph Vizzo, also played significant roles in introducing innovations in hemodialysis.

Figure 7 shows former collaborators visiting Scrib on his houseboat at Portage Bay in Seattle.

Finally, the patients played an important part in the development of chronic dialysis. The first 3 patients, Clyde

FIGURE 7 Drs. Dimitrios G. Oreopoulos (left) and Henry Tenckhoff (right) visiting Dr. Scribner in May 2001.

Shields, Harvey Gentry, and Roland Hemmings, survived for more than 10 years and provided an excellent example that well-documented observations in a limited number of patients can validate a new therapy, without costly, prospective randomized studies (Fig. 8). The long-term survival of these patients constituted encouragement for those who tried to emulate Scribner's method at a time when others reported discouraging results [46]. Dr. James R. Albers, the fifth patient, survived 35 years of uninterrupted hemodialysis sessions, including 30 years using a shunt for blood access.

Robin Eady and Peter Lundin are two other famous patients that started hemodialysis in Seattle. Robin Eady, a 21-year-old medical student at Guy's Hospital in London, started hemodialysis in Seattle in 1963. He ultimately returned to London and dialyzed at home until he received a kidney transplant after 25 years of hemodialysis. While on dialysis, he graduated with honors from medical school, specialized in dermatology, and is now Professor and Consultant Dermatologist at St. John's Institute of Dermatology and St Thomas' Hospital in London [47]. Peter Lundin, an undergraduate student at Santa Clara University, learned self-dialysis at the Remote Home Dialysis Program of the University of Washington in 1966. While on home dialysis he graduated from Stanford University with a BA degree, graduated summa cum laude from Downstate Medical Center in Brooklyn (now SUNY), specialized in nephrology, and became a Professor of Medicine in 1995 [48]. Dr. Lundin received a kidney transplant in 1991 but had to return to dialysis after a few years. He died in March 2001, 35 years after starting dialysis. The long survival and degree of rehabilitation of these 2 men is a tribute to the method of dialysis developed in Seattle. Both men learned dialysis in Seattle and continued it essentially unchanged at home.

For his achievements, Dr. Scribner has received numerous awards and honors. He was honored by the Washington State Historical Society as one of the 100 Outstanding Citizens of the State during the first 100 years of the state for the Centennial year in 1988. He received honorary degrees from the University of Göteborg, Sweden, in 1980, and the Postgraduate Medical School in London, England, in 1985. In 1994, the American Society of Nephrology established the Belding H. Scribner Award. He received an Outstanding Achievement Award from the University of Minnesota in 1964, the Gairdner Foundation Award in Toronto, Canada, in 1969, the Distinguished Achievement Award from Modern Medicine in 1972, and the John Phillips Memorial Award of the American College of Physicians (shared with Willem Kolff) in 1973. Dr. Scribner is an Honorary Member of the Swiss Society of Internal Medicine and the European Dialysis & Transplant Association. The achievements of Dr. Scribner are certainly worthy of a Nobel Prize and this was actually under consideration [49]. It is unfortunate that the Nobel Prize Committee has not honored Dr. Scribner, whose dialysis methods have saved the lives of millions of patients across the world.

FIGURE 8 Three of the 4 original chronic hemodialysis patients visiting Dr. Scribner on the 10th anniversary of chronic hemodialysis. (From the left: Harvey Gentry, Clyde Shields, Dr. Scribner, and Roland Hemmings)

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