Joseph Schatzker

Maurice Edmond Müller—In His Own Words

Among the giants of medical history—Lister, Pasteur, Jenner, Hunter, and others—who transformed our understanding of the human body, healed the sick, and extended the lives of millions, we can include Maurice E Müller. He was a Swiss surgeon who revolutionized fracture care and reconstructive bone surgery. Because of his work on stable internal fixation and immediate rehabilitation, patients with even the most complex joint fractures can now expect to have normal function and his contribution to the development of total joints has completely changed the expectations of old age.

In this book, Maurice Müller, responding to the questions of his student and colleague Joseph Schatzker, tells, in his own words, how he brought about a surgical revolution in the second half of the 20th century.

ISBN: 978-3-905363-12-8

www.aofoundation.org

AO Foundation

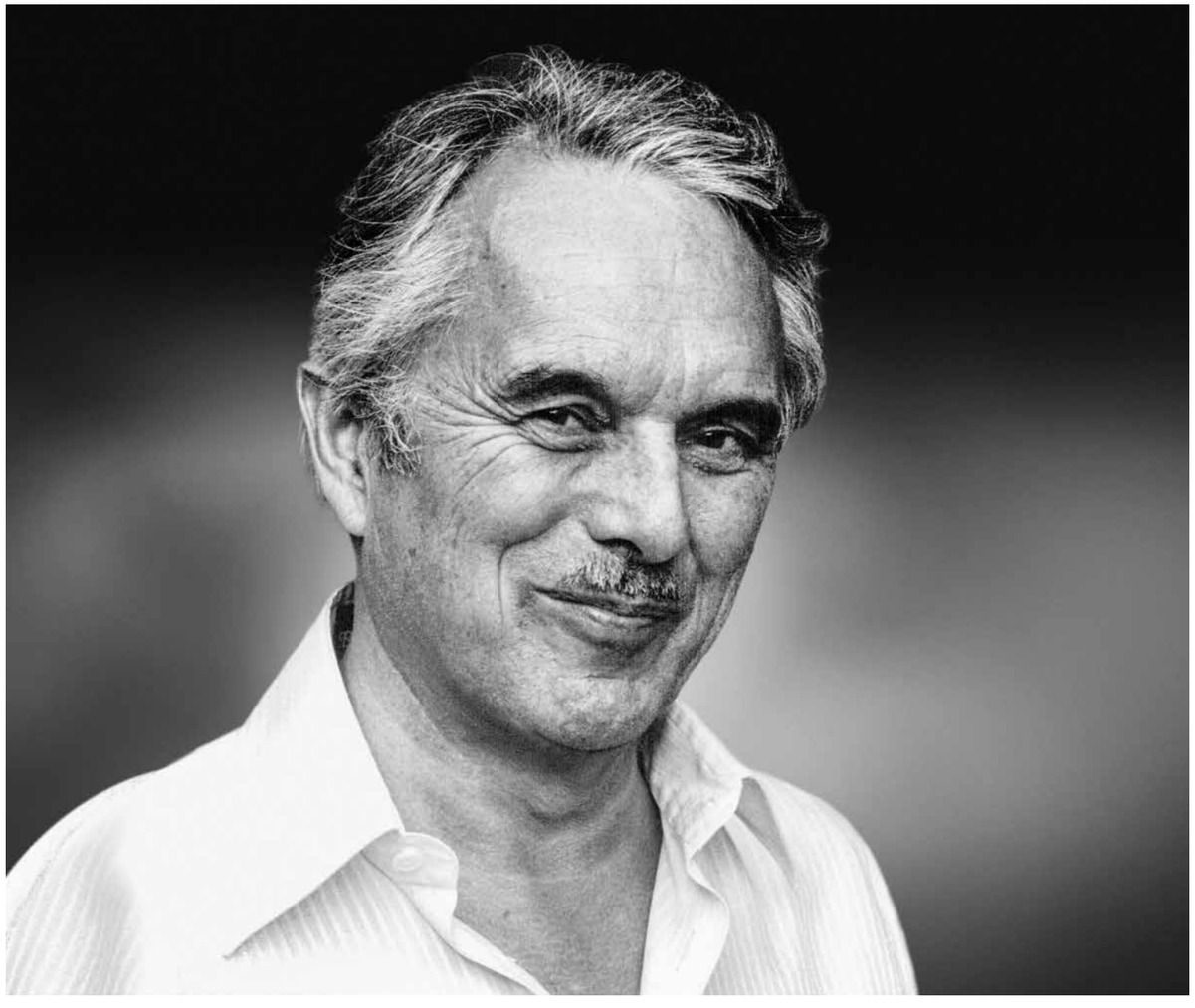
Joseph Schatzker

Maurice Edmond Müller—In His Own Words

AO Foundation

Joseph Schatzker

Maurice Edmond Müller—In His Own Words



The third 20 years

The founding of the AO: November 6, 1958

JS: So far, we've discussed the meeting of the group of surgeons on March 15, 1958, at Martin Allgöwer's hospital in Chur. Who participated in the meeting in Biel in 1958?

MEM: There were thirteen of us who founded the Swiss AO. We met on November 6, 1958, the day before the meeting of the Swiss Surgical Society, in the Hotel Elite in Biel. We formally constituted and registered the group as the Arbeitsgemeinschaft für Osteosynthesefragen (the Association for the Study of Osteosynthesis).

Each member of our group brought different strengths and talents to the enterprise. Martin Allgöwer was very valuable. He had a clinic in Chur, one of the largest in Switzerland. His staff included two chief residents and ten assistants. He was intelligent, perceptive, and a good speaker—very quick on his feet when he replied to questions at medical meetings, often with a good sense of humor. He was also the only one in our group who spoke English. Martin encouraged academic activity, and even while he was still a chief resident, he insisted that every assistant undertake a scientific study and write papers. He was strict but known for being fair.

JS: What sort of political connections did he have?

MEM: Neither he nor I had political connections. In Switzerland, we did not try to advance through personal connections. We believed in fairness, not corruption. There might have been something like that in the French part, but not in the German-speaking part of Switzerland. However, Martin was well informed and understood politics. When I applied for my position in St Gallen in 1960, he supported me and spoke on my behalf to the health authorities of the canton.

JS: What did Martin achieve in Chur that brought him such fame?

MEM: He had written a well-known book about research, the only book on surgical research ever published by a Swiss surgeon at that time. It dealt with his research into monocytes and cultures. He was the only surgeon in Switzerland who did research on animals. In those days, only pharmaceutical companies did this kind of research. Martin had also learned about advanced cell culture experimentation when he was in Texas for a year and had lectured about his research. His experience was useful when we began to study the safety of the materials we were using in surgery and in the manufacture of implants.

Hans Willenegger was a professor at the University of Basel, chief of the large clinic in Liestal. He was a wise, experienced trauma surgeon who also had research experience. His clinical acumen, his interest in research, and his wide circle of friends were all extremely important when the organization was coming together.

Robert Schneider, tall, with a military bearing, was active on the board of the Swiss Surgical Society. When he was chief resident in general surgery under Karl Lenggenhager in Bern, he had been considered a bright, young surgical star, whose interests were academic. He was supposed to become a privatdozent and even to have had a chance to become professor in Bern. Somehow, he crossed Lenggenhager who told him that he would appoint only those who listened to him and who were absolutely loyal. In those days, the chiefs of clinics had unbelievable power over their assistants and easily determined their success or failure in their profession.

Walter Bandi from Interlaken, Walter Schär from Langnau, and Walter Stähli from Saint-Imier were Schneider's close friends and loyal supporters. Two members in our young group, René Patry and Ernst Baumann, represented valuable political currency for a fledgling surgical organization. Patry, professor at the University Geneva, was more politically influential. At the time, he was vice-president of the Swiss Surgical Society and one year later he became president. Baumann was president of the Swiss Society for Trauma Surgery and an honorary professor and chief in Langenthal. I knew both well, since I had visited their hospitals to demonstrate my techniques. Fritz Brussatis was at Balgrist Hospital where he was an assistant with special responsibility. We also had August Guggenbühl, who was Willenegger's chief resident in Liestal. Willy Hunziker, was Martin's friend, and Walter Ott was chief of the clinic in Rorschach where I had done a great deal of surgery. These men and I were the thirteen founders of the AO.

"Our first official meeting of the Swiss AO took place on March 5–6, 1959, in the City Hospital in Waid in Canton Zürich." MEM

The early meetings of the Swiss AO

MEM: After the founding in Biel in 1958, our first official meeting of the Swiss AO took place on March 5–6, 1959, in the City Hospital in Waid in Canton Zürich. Drs Molo, Bloch,[1] and Kaiser[2] were taken in as new members. It was the first expansion of the membership. At this meeting, we held the first discussion about prospective documentation being obligatory for all members. This was the first time that the group discussed the documentation code sheets A, B, and C, which I had designed. This was also the first time that I demonstrated the new compression plate I had designed with a corresponding tension device. It was also the first time that the group discussed the formal opening of the documentation center and the new Laboratory for Animal Experimental Surgery in Davos, planned for June 1959.

Our second official meeting was on November 21, 1959. Once again, we met in the City Hospital of Waid. The statutes for AO Switzerland, which we had prepared, were unanimously accepted.

Our third meeting on March 8–9, 1960 was hosted by Bandi in Interlaken; this was the first time that guests were invited to take part.

1 Hans-Rudolf Bloch (1913–2003) was the chief of surgery and obstetrics and gynecology at the Canton Hospital in Glarus from 1952 to 1973.

2 Ernst Kaiser (1903–1967) was chief surgeon at the Wädenswil Hospital in Canton Zürich from 1935 to 1953, after which he was chief of surgery and director of the Waid Hospital, Canton Zürich from 1953–1967.

JS: Maurice, how were plans for your own career proceeding during the time that you were working on implant and instrument design and planning the establishment of the AO?

The new hospital in St Gallen

MEM: Well, when I left my position at Balgrist in September 1957, there was already talk of the new trauma and orthopedic hospital to be built in St Gallen. It was to replace the ageing surgical clinic there that was no longer able to cope with modern demands. There was talk at Balgrist about who would be appointed chief of orthopedic surgery in the new hospital. My name came up frequently in these discussions. When Professor Francillon heard that I was contemplating leaving Balgrist, he threatened that if I left he would make sure that I would not be appointed to this new job, but if I stayed I would be certain to get it. Despite these threats, as I explained earlier, I was fully prepared to suffer the consequences.

In 1957 and early 1958, the newspapers were filled with stories about the new, state-of-the-art hospital to be opened in St Gallen in 1960 (**Fig 20**). It was to be a 400-bed hospital, designed not only to supplant the old Canton Hospital of 300 beds but also to have the largest department in Switzerland that would be devoted, almost exclusively, to the treatment of musculoskeletal injuries and orthopedics. In late 1958, an official announcement appeared in the newspapers advertising the position of chief. The advertisement stressed that the applicant had to be a consultant in both orthopedic surgery and general surgery because in addition to orthopedics he would also treat trauma, which in those days was considered a general surgical discipline. In the spring of 1959 I decided to apply.

Fig 20 St Gallen hospital in 1960.

JS: What significance was this new hospital supposed to have for Switzerland?

MEM: To understand the significance, you must realize that Switzerland is divided into regions. One region, for instance, is Zürich, not only the city but also the surrounding area. The area to the north of Zürich, which stretches as far east as Austria and Germany, is referred as east Switzerland. It became world famous because of its textile industry which, to this day, is clustered around St Gallen, the capital city of Canton St Gallen. One of the larger cantons, St Gallen stretches as far as Schaffhausen to the north and Graubünden to the south.

The old Canton Hospital, built toward the end of the 19th century, had been in use for more than fifty years and was showing its age. It was a general hospital with many subspecialties, some of which had reached levels of excellence and fame. This was particularly true of the department of ophthalmology, which was unquestionably one of the best in the world. Amid all these specialties was a large department of surgery.

The chief of the old Canton Hospital in St Gallen, whose surgical beds were almost always full, was Josef Oberholzer. He was not the most famous general surgeon in Switzerland, but was certainly a solid figure. It was his dream that the new hospital, enlarged by another 100 beds, would present a unique opportunity to introduce a new concept, namely a clinic divided into 200 medical and 200 surgical beds. These plans were being made in the mid-1950s.

Dr Oberholzer thought that since modern surgery was now a multispecialty field, the department of surgery could no longer be effectively led by a single person who was a general surgeon. He wanted to get the support of the other department heads for his dream that the department of surgery would include the largest department for musculoskeletal trauma and orthopedics in Switzerland. Other departments, such as neurosurgery and urology, would also be included, but the creation of a department for what he called "extremity surgery" was most important for him. The largest component of this new department of surgery would be for trauma and some reconstructive procedures. He felt that other surgical specialties would mature with time and become departments within the department of surgery, but at this point the time was ripe for a department of extremity surgery.

While these discussions were proceeding, I was still chief resident at Balgrist. Since I was one of the few surgeons who had a degree in both general surgery and orthopedic surgery, I thought I was particularly suited for the job of chief of this new department. It was also time for me to leave Balgrist. I had become a mature surgeon there, but now it had little more to offer. On the other hand, I had to consider that since 1952 I had done only orthopedic surgery and no trauma.

Construction of the new clinic was to take between three and four years. Since it started in 1955, 1960 was the projected year of completion. It is important to appreciate that up to this point, most medical appointments to St Gallen were made from Zürich, with a few from Basel. The University of Zürich considered that St Gallen fell under its wing and preferred that new appointments be made

from its own ranks. Even though I was now in Zürich, I was born in Biel in Canton Bern and had studied in the French-speaking part of Switzerland. Thus, as a Welcher and a Berner I was removed from east Switzerland. Nevertheless, I felt that I had to persevere. Bern was also due to have a new hospital and would make appointments in the future, but for the time being St Gallen was certainly the best opportunity.

The other option was to wait until Professor Francillon retired. I would be certain to be appointed as his successor in Zürich. But both Bern and Zürich were in the future, not the present. I considered all these options in 1957 while still at Balgrist. I said to myself: "You are thirty-nine, married, with three children, and you earn only a modest 1,500 francs per month." To afford a holiday or pay taxes, I had to supplement my income with earning possibilities outside of my hospital duties, such as doing medical assessments. I had become aware that even though I was only a chief resident, I had become famous locally. I was doing surgery that no other surgeon was willing to touch, such as an osteotomy of the femoral neck or a three-plane intertrochanteric osteotomy for the treatment of a slipped capital epiphysis. I had begun to introduce procedures at Balgrist that had never been done before under its roof. This contributed to my fame. Moreover, I was aware of all that was being done in orthopedics, even in faraway England.

I had two choices: go into private practice or strengthen my position as a potential candidate for St Gallen. I knew that having done no trauma for the past four to five years was a problem. The papers were full of the fact that a prospective candidate had to be good in trauma as well as orthopedics, since the hospital would specialize in both.

JS: Maurice, which names were circulated as potential candidates?

MEM: The authorities looked around to see who might be a potential candidate and saw that among my contemporaries, I was the only one who had specialty degrees in both general surgery and orthopedics. Another candidate appeared a bit later, but I felt that he was not a competitor I had to worry about.

JS: Did more than one level of government have to agree to this appointment?

MEM: Not really. In Switzerland we have different levels of government. Since this was an appointment in the capital of a canton, the canton politicians would have influence. In Switzerland, the cantonal authorities are the important politicians, not the federal. The university was subordinate to the authorities of the canton.

The second consideration that made St Gallen appealing was that if I were to be appointed to St Gallen, I would be in a position to create an "academy." St Gallen had a university, but it had only commercial faculties and was famous in business circles. I thought that once on staff at St Gallen, I would likely be able to establish a school of medicine, strictly for the clinical years, not for the preclinical disciplines. In other words, it would be what one calls an academy. I had these thoughts in 1955, and that's why I went to Vienna in late 1956 to study Böhler's school, famous for its superbly well-organized system for conservative treatment of fractures.

Although Böhler's was the best conservative school in all of Europe, if not in the world, it was not an academic center. It had grown out of the workers' injury insurance hospital. In Vienna, they laid tremendous emphasis on mobilization of the patient and of the joints which did not have to be immobilized in plaster. Only the injured part was immobilized in a skin-tight cast, while all the patient's uninjured joints were exercised. For fractures of the femur, they used traction combined with early motion of the knee. Fractures of the tibia were treated initially with traction, then in skin-tight casts. If they couldn't maintain reduction in upper extremity fractures, that is forearm fractures, they were then treated with K-wire fixation and further cast-immobilization. All ankle fractures were treated in long-leg casts. If reduction could not be maintained, K-wire fixation was added. They knew nothing about plating and had no idea about lag screw or cerclage fixation. I was surprised that they knew nothing about Pauwels and his concepts of biomechanics, even though all his publications were written in German. I could also see that they knew little about operative fracture care and had nothing like the level of excellence in fracture treatment that I reached during my stay in Fribourg. At the time I paid them a visit in Vienna, they were just beginning to use the Küntscher type of intramedullary nailing.

"The next big event in my life was my trip to the United States in June and July 1959. I had received a personal invitation from Professor Blount from Minneapolis to attend the meeting of the American Orthopaedic Association." MEM

However, I could see that the organization of all their procedures in a rational system facilitated the treatment of a large number of patients. They also greatly emphasized early rehabilitation, as well as careful documentation. This system made me realize that we could create a similar model for operative fracture treatment.

In the early spring of 1959, I applied for the position in St Gallen. By then I had spent almost a year and a half doing surgery all over Switzerland and abroad. I directed my letter of application to the health authorities of Canton St Gallen. I was not the only candidate. By now there were six others. However, in May 1959 I was told that there were only two candidates. I was one and the other was Dr Balmer who was working in Biel.

The first hint of opposition to reach my ears about my application, albeit unofficially, was that the university of Zürich was strongly opposed to my appointment. I suspected immediately that Professor Francillon and his supporters had intervened, but I was not certain.

The next big event in my life was my trip to the United States in June and July 1959. I had received a personal invitation from Professor Blount from Minneapolis to attend the meeting of the American Orthopaedic Association (AOA). Before leaving on my trip, I decided to write to the authorities to tell them that I would be returning from the United States by the end of July, and if the appointment to St Gallen had not been finalized by then, I would withdraw my application. I felt that I simply could not continue as an itinerant surgeon traveling about Switzerland and that the time had come to make a change.

First trip to North America: June 1959

MEM: My first journey to the United States happened eight months after the official foundation of AO. I wanted very much to visit America. Professor Walter Blount, whom I met while visiting Pauwels, invited me to the AOA meeting in Lake Placid in the northern part of the New York State. It was quite an honor to be invited by such a famous man; I was very excited.

I traveled by ship. The journey took six days, three of which were stormy. Most passengers were seasick; I was no exception. While on board, I met a young Swiss woman, who had moved to New York and was returning home. We became good friends, helping each other during the time we were seasick. Once the storm had passed, I asked her if she would be interested in being a representative for the AO. I explained that we had just established a new association and that I wanted to establish an office in New York. If someone from North America should want to write to us, we would have a North American address. She was pleased to accept and for a fee allowed us to use her address. In addition, she promised that whenever an official letter arrived, she would forward it to my address in Switzerland. Thus, even before I arrived on North American soil we already had an American office.

Three years later, we faced a court challenge over the name "AO" in North America. I had never heard of American Optical, but it had registered the name AO. Therefore, the official name, in North America only, became ASIF, the Association for the Study of Internal Fixation.

Shortly after arriving in New York on a Tuesday morning in early June, I phoned Professor Stinchfield[1] at the Presbyterian hospital. I had not met him, but I knew that he was famous and influential. I told his secretary that I had just arrived from Switzerland and wanted to see him the next day, even for a few minutes. She proposed an appointment in two weeks. I tried to explain to her that two weeks would be impossible for me. While I was discussing this with her on the phone, I heard that the office door had opened. Going out on a limb, I said, "That is surely your boss! Please, ask him if he would have a few minutes tomorrow for a Swiss surgeon who has come specially to meet with him." In her surprise, she allowed me to speak to the professor.

Professor Stinchfield said "Yes. you can come to my office at 8:00 a.m. before I begin surgery. By 8:30, we can go into the operating room together." I introduced myself at eight o'clock and showed him a few slides. After the first few, Stinchfield wanted to see more and more. Time flew. Suddenly, seeing it was already nine o'clock, he said,

"I must run to the operating room. What you show is so fascinating that I advise you to visit Andy Bassett,[2] who is doing research in my department. Show him your work. I would like to meet with you again when I am finished in the operating room."

Fig 21a–b Maurice lecturing.

1 Frank Stinchfield (1910–1992) was professor and chairman of the orthopedic department at Columbia University, chief surgeon and director of Columbia-Presbyterian Medical Centre, chief surgeon of its New York Orthopedic Hospital division, and medical director and surgeon of its Institute for the Crippled and Disabled.

2 C. Andrew L. Bassett (1924–1994) was a professor at Columbia University and assistant attending orthopaedic surgeon on the staff of the Presbyterian Hospital from 1955.

Although I was a total stranger, I had caught Stinchfield's attention. When I saw him at eleven o'clock, he wanted to see all my eighty slides, particularly those dealing with stable fixation of fractures with compression and immediate mobilization. He then invited me to grand rounds on Thursday to show them again, this time to his department and anyone else attending. I told him I could not speak English very well, but he said that he understood me well enough and that no one in the United States had seen anything like what I had shown. I asked who might be there.

He replied, "McLaughlin."

I asked if that would be the McLaughlin[1] of the nail and plate. If so, I knew him by reputation. He mentioned a few more names. Some were famous and familiar, most not.

On Thursday, I was the guest presenter at grand rounds held in a huge room. There were not many people in the room. After welcoming me, Stinchfield said that I was going to show them three things that they had never seen: first, treatment of pseudarthrosis with plating and compression without bone grafting and without resection of the pseudarthrosis tissue; second, the treatment of acute fractures with open reduction and absolutely stable fixation with the use of compression followed by immediate mobilization; and third, hip surgery with techniques that may have been known to some, like Walter Blount, but not generally.

I showed them my cases of pseudarthrosis, of intertrochanteric osteotomies with joint space regeneration, and cases of slipped capital epiphysis treated with osteotomy of the femoral neck, with late follow-up to prove that avascular necrosis did not take place. When I started, there were only a few present, but after a few minutes the place began to fill and in about twenty minutes, the room was full, and people were sitting on the steps and on the floor (**Fig 21a–b**). I answered questions at the end of my one-hour presentation. When it was over, Stinchfield asked me to come the next day, Friday morning, so that he could plan a journey for me through the United States. I came at ten o'clock.

"You should go to Chicago," he said, and listed the names of several surgeons to see. "Then to Milwaukee to Blount, whom you know. Then you must go on to the Mayo Clinic and from there to San Francisco. Then you should go south to Los Angeles."

With each of the names he mentioned, he picked up the telephone, called his friends to introduce me, and arranged my entire trip. He told everyone he called that he had just had grand rounds with a Swiss, whose findings were so fascinating that they had to see them. He arranged twenty-five places for me to visit. Prior to my departure, we spoke about the forthcoming SICOT[2] meeting to be held in 1960 in New York. Before I left, I asked if I could come and see him in July after my twenty-five visits. He said that he would be thrilled to see me again.

"[Stinchfield] picked up the telephone, called his friends to introduce me, and arranged my entire trip. He told everyone he called that he had just had grand rounds with a Swiss, whose findings were so fascinating that they had to see them." MEM

1 Harrison McLaughlin (1906–1970) became chief of the fracture service at the New York Presbyterian Hospital and clinical professor of orthopaedic surgery.

2 Société International de Chirurgie, Orthopaedique, et Traumatologie.

The first place on the list was Milwaukee. Dr Blount was a gentleman. He invited me once again to be his guest at the AOA, which was about to start its annual meeting in Lake Placid. From Milwaukee, I went to the Mayo Clinic, where I was received by Drs Bickel[1] and Coventry,[2] who gave me a warm reception. I was amazed how well they operated because what I had seen in North America so far was generally not impressive. After the visit in the clinic, Bickel asked,

"By the way, do you ride horses?"

I said that I had ridden in the military. He phoned and spoke to his wife. When we arrived at his home, outside of town—almost in the country—three horses were ready for us. His wife offered me one of her riding outfits, and suddenly we were on our way. I had not ridden for ten years. We started slowly and then rode faster and faster around the many small lakes in Minnesota near Bickel's home. Somehow, I survived. I had a marvellous time.

After this visit, I returned to Milwaukee and Blount and I took a plane to Lake Placid. I found the behavior of the members at the AOA most surprising. In Europe, men and women mixed together at meetings. At receptions in America, I discovered that the men gathered on one side and the women on the other. I wanted to speak with some of the ladies who had been so nice to me, but their husbands insisted that I come and talk with them. I was really surprised but would soon learn, the more I traveled, that almost every country had its own code of behavior.

From Lake Placid, I went to San Francisco where I was received by Soto Hall,[3] whom I had heard speak at a SICOT meeting. My lecture caused great excitement. I was requested to do a couple of operations and agreed to do two cases the next day. One case was a pseudarthrosis of the femoral neck and the other a case of osteoarthritis of the hip. I was taken aback. These were not easy cases. I had brought plates with me, since I thought that I should be ready if I were asked to demonstrate surgery. People came from Los Angeles to see me and were present in the operating room observation area the next day. They were amazed by what they saw and said that it was indeed what Stinchfield had described. They immediately asked if I would come Los Angeles. I agreed and gave lectures there. I also performed operations in three hospitals.

1 William H Bickel was president of the American Orthopedic Association in 1964.
2 Mark Bingham Coventry (1913–1994) joined the staff of the Mayo Clinic in 1946. In 1958, he became professor of orthopedic surgery and was department chairman from 1963 to 1974.
3 Ralph Soto-Hall (1899–1993) was assistant professor of orthopedic surgery at the University of California Medical School, San Francisco.

On the way back east, I visited Boyd[1] at the Campbell Clinic in Memphis. He showed me one case of a forearm fracture fixed with K-wires. After I had shown my cases of fractures fixed with plates, particularly the pseudarthrosis of the forearm, he realized that there were better ways to deal with these injuries. A few years after my visit, Anderson[2] published an article in the journal *Bone and Joint* about his cases of forearm fractures treated with the Synthes compression plates.[3] This paper really made our reputation in the United States.

"...Anderson published an article in the journal Bone and Joint about his cases of forearm fractures treated with the Synthes compression plates. This paper really made our reputation in the United States."
MEM

After visiting Miami, I went to the Johns Hopkins Hospital in Baltimore, where I knew of Robert Robinson.[4] While still a resident at Balgrist, I had done a cervical fusion according to his method. He was amazed that that I had done a case of spine fusion that he had described and was excited by the various cases I showed him. Next, I visited Shands[5] at the duPont Institute in Delaware. I knew his resident MacEwen[6] from SICOT. Some years later, when we met in New Orleans he reminded me of this meeting. I gave twenty-seven lectures before I returned to New York, where I had to give two more. I also operated on one surgical case at the Hospital for Joint Diseases, an institution which I found impressive.

Because of my American visit, I became a good friend of Stinchfield who invited me to be his guest at the second meeting of the American Hip Society in 1971; on that occasion, I was made an honorary member. In 1975, we met again at the SICOT meeting in Copenhagen. It was at this meeting that John Charnley, Stinchfield, and I decided to found the International Hip Society.

My trip in 1959 was my introduction to the American orthopedic world, which I found very different and somewhat difficult to understand, but at the same time admirable in many ways. I had made many important friends on my journey through the United States. I know that I made a great impression on the American orthopedic community with my technical skills and with my new ideas and operations.

Return from America: the position at St Gallen

MEM: Upon my return home toward the end of July 1959, I phoned the authorities responsible for the appointments at St Gallen. They could not give me an answer immediately but promised that I would get an answer by mail. Soon after my phone call, I received a letter in which the authorities informed me that Dr Balmer from Biel was the successful candidate. I was a little disappointed, but it is not in my nature to dwell on things that do not turn out well. What would be the next step to make? I was out of work. In the years after my departure

1 Harold B Boyd (1904–1981) joined the staff of the Campbell Clinic in Memphis, Tennessee, and was chief of staff from 1962 to1970. He was also professor and chairman of the department of orthopedics at the University of Tennessee from 1958 to 1971.
2 Lewis D Anderson (1930–1997) worked at the University of Tennessee in Memphis from 1960, where he was professor of orthopedic surgery from 1971 to 1977.
3 Anderson LD, Sisk TD, Tooms RE, Park WI, III. Compression-plate fixation in acute diaphyseal fractures of the radius and ulna. *J Bone Joint Surg*. 1975;57-A:287–297.
4 Robert A Robinson (1924–1990) was appointed as the first full-time professor of orthopedic surgery at Johns Hopkins Hospital in Baltimore, Maryland in 1953.
5 Alfred R Shands (1899–1981) came to Wilmington, Delaware to be first director of the Alfred I du Pont Institute for Crippled Children. He held this position until his retirement in 1969.
6 G Dean MacEwen was the medical director of the Alfred I du Pont Institute from 1969–1986.

from Balgrist I had built a booming private practice. The next opportunity had to seal my future. I was not going to be an itinerant surgeon forever. I realized that I wanted professional success and a more meaningful appointment than private practice. Apart from my practice, however, the immediate issues were the developments of the young AO soon after its founding.

1960: the extraordinary year

JS: We are coming to 1960, an extraordinary year of your life.

MEM: Yes, things were beginning to move faster and faster. During the winter of 1959–1960, the four AO clinics, Chur with Allgöwer, Liestal with Willenegger, Interlaken with Bandi, and Grosshöchstetten with Schneider treated all their patients according to the new AO principles. This meant immediate surgery for all fractures, stable osteosynthesis, no postoperative plaster cast fixation, and immediate mobilization of the extremity. All cases would be prospectively documented.

In the spring, general surgeons in Basel and Zürich noticed a great drop in their surgical case load. It also reached our ears that the people on the street had begun to talk about our completely new way of treating broken bones, saying that this technique appeared to have no limits. Then athletes, who frequently communicate among themselves, began to spread the word saying that our treatment was greatly superior to that of the university clinics. When patients began to seek treatment from Schneider in Grosshöchstetten, a small community hospital not far from Bern, the general surgeons of Bern were really annoyed.

Meeting of the Swiss Surgical Society: May 1960

MEM: The annual meeting of the Swiss Surgical Society was held in May 1960 in Geneva. Professor Patry, a founding member of the Swiss AO, was president. The program had been printed and distributed, but because of pressure from the general surgical community, Patry added, at the last minute, four lectures given by Martin Allgöwer, Hans Willenegger, Robert Schneider, and me that would explain what AO was all about. It was meant to be an information session designed to calm everyone down.

I spoke on the principles of stable internal fixation. Martin Allgöwer was able to speak authoritatively about lag screw fixation of fractures of the tibia from the cases he had accumulated in his own hospital. Hans Willenegger spoke on fracture dislocations of the ankle—an old subject for him—which he no longer treated with K-wire fixation, but now with stable lag screw fixation and plating where necessary. Finally, Robert Schneider spoke on intramedullary nailing of fractures of the tibia.

The lectures created a great furor among the members of the surgical society. They had many burning questions to ask but since the lectures were given at the end of the meeting, there was no time for formal discussion. One could sense the tension and dissatisfaction of those present, since our presentations had not allayed their fears. In response some weeks later, the Swiss Surgical Society called for an extraordinary meeting scheduled for November 1960.

The appointment to St Gallen

MEM: Then to inject further excitement, on August 16, 1960 an official announcement was published in all newspapers saying that Dr Balmer had resigned from St Gallen and that I had been appointed as chief of the new clinic. The reasons for Dr Balmer's sudden resignation took a while to surface. The first time he came to inspect the new hospital in St Gallen was in August 1960. He realized then that the huge, new clinic was much more than he could handle. Since his clinic in Biel had fewer than fifty beds, he could not imagine how he would fill 200 beds. His fear was realistic. He had neither the reputation nor the experience I had.

His sudden, unexpected resignation caused a great scramble on the part of the authorities, who were faced with an organizational crisis and a political fiasco. To salvage the situation, they realized that their only hope was to appoint me. This time the appointment would be on my terms. I wanted to avoid getting involved with Zürich. My terms were not unreasonable and the government agreed to them. Around the middle of August, my appointment was announced in all the newspapers. I heard that the general surgeons were gossiping among themselves that the new clinic would become a bastion of the AO and put everyone out of business.

The second trip to the United States: September 1960

MEM: In September 1960, while waiting to accept my appointment to St Gallen, I traveled once again to the United States. This time to New York to attend the SICOT meeting which was held at the Hotel Astor. I put together a great exhibit with the help of Dr Andrew Basset, whom I had met when I visited Professor Stinchfield in 1959.

My exhibit drew many interested visitors, among whom were Professor Joseph Trueta[1] and his friend Sir Henry Osmond-Clarke,[2] two giants of British orthopedic surgery and trauma. Their reaction was far from favorable and if anything, discouraging. Professor Trueta thought I was crazy to think that I could heal bones with metal plates and made a point of saying this very loudly to his friend in the presence of many attendees.

A young Canadian, Richard Cruess,[3] also attended. He was training in surgery at the time and was undecided whether to remain a general surgeon or pursue a specialty. He was fascinated by my exhibit on the treatment of pseudarthrosis with compression and absolute stability without excision of the pseudarthrosis tissue and without bone grafting. He said repeatedly that he had never heard or seen anything like it. Years later, he told me that this exhibit opened his eyes to the future possibilities of orthopedics and made him decided to become an orthopedic surgeon. At the meeting, I also met Dr Howard Rosen[4] and his friend

1 Joseph Trueta (1897–1977) was elected to the Nuffield Chair of Orthopaedic Surgery at the University of Oxford from 1949 to 1966.

2 Sir Henry Osmonde-Clarke (1905–1986) was a consultant at Crumpsall Hospital near Manchester from 1936, and later at the Royal National Orthopaedic Hospital in London.

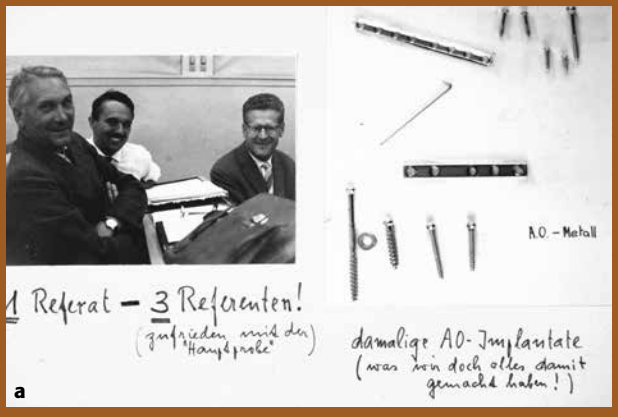
3 Richard Leigh Cruess (b. 1929) was at the Royal Victoria Hospital in Montreal from 1968 to 1981, where he was assistant surgeon-in-chief from 1979 to 1981. From 1970 to 1982, he was also the chief surgeon at the Montreal Shriners Hospital.

4 Howard Rosen (1925–2000) was associated with the Hospital for Joint Diseases at New York University from 1948, and from 1978 was chief of its problem trauma service.

Dr Herbert Sandick.[1] They were also interested in my exhibit on the treatment of pseudarthrosis, but for a different reason. Dr Sandick's uncle, a great tennis enthusiast, had a nonunion of his humerus after four failed surgeries. When they showed me his x-rays, I said, "Just bring him to Switzerland; his arm will be healed in no time and in three months he will be playing tennis once again." They were so impressed with my exhibit that they decided to attend the first AO course in December. At the end of the course, both bought a full set of instruments and implants and brought them to the United Stated in their suitcases in the hope of using them in their practice. As it turned out, that was the beginning of Howard Rosen's illustrious career as an AO surgeon. He became one of the influential pioneers in North America, even though for the first few years he was not allowed to use the instruments at his hospital. He turned to his veterinary friends and put his newly acquired knowledge to use in their animal clinic. In this way, he became a founding member of the American Veterinary Orthopaedic Association. It took a few years before his chief, Dr Henry Mankin,[2] allowed him to use the new AO implants on patients (**Fig 22a–c**).

1 Herbert Sandick practiced orthopedic surgery in Pittsfield, Massachusetts.

2 Henry Mankin (b. 1928) was professor at the Harvard Medical School, chief of the department of orthopedics at the Massachusetts General Hospital (MGH) from 1972 to 1996, and chief of the MGH orthopedic oncology service from 1972 to 2000.



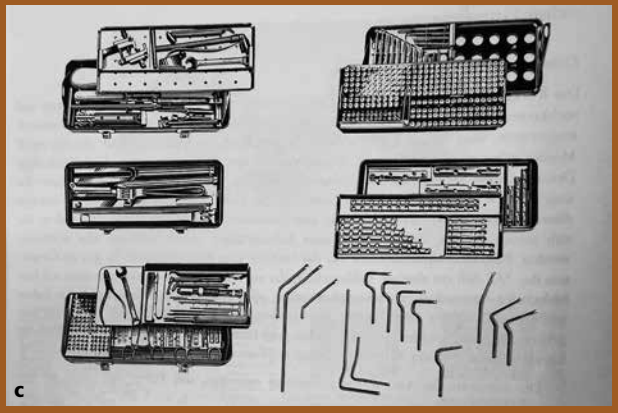


Fig 22a–c
a Hans Willinegger, Maurice, and Martin Allgöwer, together with some of their early AO implants.
b Retractors for total hip replacement.
c The new AO armamentarium designed and produced between 1958 and 1960, ready for the first AO Course.

Beginnings in St Gallen

MEM: After returning to Europe, I took over the clinic at St Gallen on November 15, 1960. I came with two chief residents. Dr Mumenthaler was Dr Oberholzer's son-in-law. He was not necessarily my first choice, but I had little time to make decisions. I chose Dr Hardi Weber as the other chief resident. I knew him from Balgrist, where he started as an assistant toward the end of 1956, while I was still there as chief resident. I was not well acquainted with him, but he was available. After he left Balgrist, he studied with Sir John Charnley in England and had become an expert in total hip replacement.

I had little time to put a team together. The appointment to St Gallen came through in mid-August and I had to take over the department in early November. I really did not know too many surgeons who might be available as assistants because I had been away from the teaching circuit since 1957. I chose five assistants. I knew Dr Christoph Meuli[1] through his father Dr Meuli Sr, who was a brigadier and chief of the medical division of the Swiss army. He knew me, since I was the head of a medical section in the army and was responsible for the rules governing the treatment of fractures. Christoph Meuli later became my chief resident. Dr Courvoisier[2] came at the end of the year and Dr Boitzy[3] started in February 1961. I also had Dr Vasey[4] who was a nephew of Dr Schneider.

On opening day, I started grand rounds with my chief residents and assistants. We started on the top floor of the hospital, where there were only five occupants of the forty beds for private patients. The next floor, the ninth, was reserved for men; there we found only ten patients. The eighth floor, also reserved for men, was empty. The seventh floor, reserved for women, had about twenty-five patients and on the sixth, the children's floor, there were four patients. On the fifth floor, the septic ward for both men and women, there were ten patients. In total, there were fifty-four patients in the hospital.

Dr Oberholzer was embarrassed and apologetic. Since it was apparent that these patients would be returning home within the next weeks, he asked me what I was going to do with the empty wards. I said I would fill the wards with orthopedic patients, treated in the modern way with osteotomies or arthroplasties. Dr Oberholzer was still not quite satisfied and pressed further, looking rather worried. He said that if I could not fill the beds in the next three or four months, the other surgical divisions in the hospital would try to take them. I replied, "It is now mid-November. Please give me three months until the middle of February. For the rest of this year, I can't to do very much. First, I must train my staff. Then I need to order the instruments and implants that I need, and last, at the beginning of December I must run the first AO course in Davos. These are my priorities for the next month and a half. On January 2, 1961, I will begin my first year

1 Hans Christoph Meuli (b. 1929) became head of rheumatoid surgery at the Inselspital in Bern in 1968.
2 Eric Courvoisier (b. 1928) worked at the Clinic for Surgery of the Motor System in Geneva and became an orthopedic consultant at the University of Geneva in 1973.
3 Alexandre-Jean Boitzy (1930) later became a consultant in orthopedic surgery at the hospitals in Sierre and Morges.
4 Harold Vasey (1930–2002) became chief of the Clinic for Surgery of the Motor System in Geneva in 1971. From 1973, he was associated with the University of Geneva and in 1977 became a professor.

with an almost empty department, but I promise you that by February 15, three months from today, I will invite the health authorities to show them what we have done. There will not be one empty bed." He just shook his head.

After I took over in mid-November 1960, I spent the first 6 weeks training my team and ordering the necessary equipment for the hospital. At that time, Mathys was not yet able to begin supplying the hospital with the new AO armamentarium we were developing. Everything had to be kept for the first AO course. At the beginning, I had to buy old equipment, like Danis' lag screw and coapteurs. I also lacked cancellous screws. I did have access to some of the new AO instruments but rather than using them clinically, I used them to train my young assistants and my two senior residents, Dr Mumenthaler and Dr Weber. Once the AO course was over, I had no difficulty in obtaining AO instruments.

My new staff had no idea about the new AO method of fracture treatment I had designed. I started with teaching them the concept of absolute stability achieved with compression and about the lag screw as the basic building block of absolute stability. For this we were going to use the new cortical screws I had designed with the round heads and the hexagonal recess to couple with the new screwdriver. They had to learn how to drill bone, to distinguish which was the gliding hole and which was the thread hole, how they differed, how to use the tap, and then how to achieve compression. Then we practiced axial compression of transverse fractures with the use of the special compressor and round hole plates. In short oblique fractures, which we could fix with only one lag screw, I taught them to use a plate to protect the screw fixation. Finally, I taught them how to fix a joint fracture with a lag screw and protect it with a buttress plate. We also had an exercise on intramedullary nailing with reaming.

I hit upon the idea of using my five assistants as the leaders of the exercises for the coming course in Davos. Each of them was assigned one method of achieving stability. The one who would be the instructor for a specific method had to know the principles of stable osteosynthesis, as they applied to the method he was demonstrating and supervising; he had to know how to carry out the procedure and learn a few clinical examples. My two senior residents were going to circulate and supervise the practical sessions. In this way, my completely ignorant crew became world experts on their specific exercises within a month, and when it came to the course itself, they had the opportunity to instruct surgeons much older than themselves. This proved not only a brilliant educational session for my team but also an unbelievable morale builder. By the end of the AO course they were all fired up and could not wait for patients so that they could put their experience into practice.

The special meeting of the Swiss Surgical Society: November 1960

JS: Before you turn your attention to the AO course in December, you and your colleagues in the AO had to face another meeting with the Swiss Surgical Society.

MEM: Yes, that's true. The extraordinary meeting of the Swiss Surgical Society began on November 24, 1960, just a few days after I had taken over as chief surgeon in St Gallen on November 15. We met in Bern at the Schweizerhof Hotel; the large ballroom was filled with at least 400 surgeons. The meeting had been carefully planned to discredit the AO and put a halt to our efforts. Three formal lectures organized by the society were given: the first by Hans-Ulrich Buff, who was chief surgeon in Solothurn at the time, but about to become the director of one of the surgical clinics at the University of Zürich, the second by Karl Lenggenhager, chief of general surgery at the old Insel Hospital in Bern, and the third by Max Geiser[1] an orthopedic surgeon, also from Bern, who worked with Professor Dubois[2]. The three, who were members of the board of the Swiss Surgical Society, led the charge against the AO group.

In his talk, Dr Buff described lag screw fixation as an old method no longer in use. He believed that if tibial fractures required surgery, intramedullary nailing was the only suitable technique. He really had no idea what he was talking about. He showed cases of distal tibial fractures he had nailed, which had to be immobilized in plaster because they were all unstable and were shortening. Drs Lenggenhager and Geiser treated all tibial fractures first with traction and then with cast-immobilization. They maintained that this was a technique supported all over the world and that the AO surgeons were about to commit serious malpractice. Dr Geiser had visited England where he was persuaded that closed fractures must remain closed.

1 Max Geiser (b. 1926) had been the chief resident of Professor Dubois and became a senior surgeon of the orthopedic department at the University of Bern.

2 Marcel Dubois (1893–1967) was chief of surgery at the University Clinic in Bern.

At the time, general surgeons were familiar with only two indications for surgery. First, the cerclage technique could be used for torsional fractures of the tibia, but it had to be combined with cast immobilization. Second, mid-shaft transverse fractures could be treated with intramedullary nails. The AO claim that tibial fractures should have open reduction and stable internal fixation, achieved with compression and mobilization after one week, was a revolutionary technique. They simply could not accept it.

Some of what we were presenting had been used in the past. The lag screw principle, for instance, had been published by Danis in 1941, but no one knew anything about it. The AO method was based on the principles of stable internal fixation that I had written down after my experience in Fribourg. Over time, I made only minor modifications, but everything had been presented publicly, particularly in my lecture on form and function which I gave in Zürich in 1957. Since 1957, Allgöwer's clinic had become very good at treating torsional fractures of the tibia with lag screw fixation. Three years later these early AO cases, which we had prospectively documented, were described in a book published in German in 1963. In 1965, it was published in English as *Technique of Internal Fixation of Fractures*.[1]

The atmosphere at the end of the meeting reminded me of hostile armies facing off in battle. The anxiety of the surgeons present was palpable. My appointment to the St Gallen clinic had further fueled their apprehension. There was also talk of my recent trip to New York in September 1960 to attend the SICOT meeting, news of which had filtered back to Switzerland. What raised the general anxiety even further was the fact that just before this extraordinary meeting, we had announced the first AO instructional course to be held in Davos on December 10, 1960. The surgeons learned that the course would include lectures on our new surgical principles and that participants would be able to practice the new techniques on actual bones using our instruments and implants. We stressed that only the new AO instruments and implants would be used at the course but that they would not be for sale. There was great alarm at this announcement. The general surgeons not only saw the dwindling number of patients but now they also realized that they would not be able to get their hands on the new AO implants and instruments. As soon as they heard this, they accused us of acting unprofessionally by withholding information necessary for patient care. To make things worse, they were upset that we were opening the door of our AO clinics to many new, visiting surgeons who would come to learn about the new techniques.

"I think the first AO course was the real beginning of the AO. I had designed it from scratch, since nothing like it had ever taken place. It was to be a first in surgical education."
MEM

They had cause to be concerned and angry. What really surprised me was that the orthopedic surgeons opposed us. Up to this time, their professional lives had been virtually free of emergencies; now they suddenly faced the idea that orthopedic surgeons would do trauma surgery and fracture treatment. To make matters even worse, we were preaching immediate surgery for all lower extremity fractures, which meant frequent emergency operations at night.

1 Müller ME, Allgöwer M, Willenegger H. *Technique of Internal Fixation of Fractures*. Heidelberg: Springer; 1965.

My AO colleagues and I felt that we had won a minor victory because the society could have taken measures to shut us down. Somehow reason prevailed and they held back from official censure. But it was apparent that the AO faced a hostile world which was far from ready to accept anything we had to offer. Things were heating up with the first AO course in Davos only a couple of weeks away.

The first AO Course in Davos: December 1960

MEM: I think the first AO course was the real beginning of the AO (**Fig 23a–b**). I had designed it from scratch, since nothing like it had ever taken place. It was to be a first in surgical education. We would not only have lectures but the participants were also going to practice the techniques of stable internal fixation on fracture models, which would be prepared for them in formalin-preserved human bone (**Fig 24a–c**). My team was very enthusiastic about teaching the participants and were pleased with their new chief. No chief ever invested as much time as I did to train his staff. They would also be allowed to take part in all the lectures of the course without having to pay the fee.

Fig 23a–b
a The first AO Course in December 1960 in Davos, Switzerland.
b Maurice demonstrating the new AO armamentarium during the first AO course.

Fig 24a–b The first AO Course—Maurice demonstrating the use of implants during the practical, hands-on exercises.

I designed the course so that the participants would receive a series of lectures that would introduce them to the AO philosophy step by step. First, we would discuss the concept of atraumatic surgery. The participants had to be reminded that since only living bone can heal, exposing the fracture must be atraumatic to preserve the viability of bone. Next, one must restore form in order to restore function. This means anatomical reduction of the fracture. Once form is restored, it must be preserved. This means internal fixation. To ensure healing and freedom from pain, the fixation must be absolutely stable. Then, early mobilization of the extremity is undertaken so that a full range of motion can be regained. By following these fundamental steps, posttraumatic complications can be avoided.

The lag screw is the key to absolute stability. It is best suited for torsional fractures and for long, oblique fractures. If the fracture is short and only one lag screw can be used, it must be protected with a plate. Transverse fractures, such as transverse fractures of both bones of the forearm, cannot be fixed with a screw. They must be fixed with compression plates. Compression plating is best suited to fractures of the upper extremity. Transverse fractures of the lower extremity are best fixed with an intramedullary nail. Nails are stronger and allow earlier weight bearing.

I divided the lectures among my faculty. I lectured on the principles of stable osteosynthesis and how it avoids posttraumatic complications like plaster disease. Allgöwer spoke about lag screw fixation, alone or in combination with plates. Willenegger talked about articular fractures, which he illustrated with the most common intraarticular fracture, the fracture of the ankle fixed with screws and plates. Schneider spoke about intramedullary nailing of the tibia. Since these were the lectures we gave at the May meeting of the Swiss Surgical Society, they had already been prepared and we could modify them where necessary.

JS: How many people came to the first AO course?

MEM: We had originally planned to have twenty-five participants but there were over eighty. They all participated in the four practical exercises (**Fig 25a–b**). This was an original innovation at the time; nothing like it had ever been tried. It was such a success that we maintained the same organization with minor changes for years. The themes of the lectures also changed little over the next ten years. Only three foreign participants had been invited to the first course: Irwin Leinbach[1] from Florida, Howard Rosen from New York, and his friend Dr Herbert Sandick. The first AO course was a great success (**Fig 26**). We felt that we were making history. There was great anticipation on the part of the participants. All wanted to buy the equipment but we had warned them that it would not be for sale, since only the instruments needed for the course had been manufactured.

1 Irwin Leinbach (1907–1994) practiced orthopedic surgery in St Petersburg, Florida.

Fig 25a–b Participants at the first AO Davos Course, Switzerland.

Fig 26 The first AO Davos Course in December 1960. Maurice is seated in the middle, surrounded by the faculty.

At this point I realized that Mathys and I had to formalize our relationship. We had been working together with only a verbal agreement. The first AO course coincided with a new financial structure. It was the first formal arrangement between the doctors and industry. In December 1960, the AO signed a contract with Robert Mathys and established Synthes AG Chur as its financial institution.

The financial structure of the AO and the birth of Synthes AG Chur: 1960

JS: This brings us to business matters. An organization like the AO needed financing. How did you organize this?

"In December 1960, the AO signed a contract with Robert Mathys and established Synthes AG Chur as its financial institution." MEM

MEM: At the beginning, we paid for everything out of our own pockets. Each of us, Martin Allgöwer, Robert Schneider, Walter Bandi, Hans Willenegger, and I put 10,000 francs into the account, not once, but twice. It was at this point that I realized that to survive in the future, we had to find a way to secure a sound funding basis. To push forward at a fast pace, we needed our own funding without the encumbrance of government or academia.

I had also been very busy designing new implants and instruments. Once I had met Mathys in April 1958, we began to work at a rapid pace. He understood my condition that nothing would be sold until we had proven its efficacy and clinical safety. We agreed that Mathys would be the exclusive manufacturer and distributer of all the instruments and implants of the AO which I had designed and patented. As you recall, they were organized into five boxes according to their purpose. The twenty sets that were ready for the participants' use in the first course represented a considerable financial investment.

"...the royalties that flowed into Synthes AG Chur were not for personal use, but were destined to support the enterprise, so that we, as shareholders, would have no financial benefit from the organization." MEM

At the beginning, we sold only a few of the new implants and instruments to the pioneering clinics through my sister Violette. We realized that once we started to sell the new armamentarium, money would begin to flow. We also understood the need to distance ourselves from the sale of the instruments we designed, so that by recommending them to our colleagues, we would not be in conflict. We decided that the receipts from the sale of our instruments and implants would not be paid to us as income, but would be directed to an organization that would look after the support of our research, development, and all other academic-related expenses. Synthes AG Chur would become the financial arm of AO Switzerland. It would be the owner and licensor of all the patents and intellectual property of the AO and would own Synthes, our trade mark. Synthes AG Chur would license Mathys to be our exclusive manufacturer and distributer. The Swiss AO doctors would be responsible for all medical affairs, such as research, teaching, and development.

Mathys, as licensee, would pay a royalty to Synthes AG Chur for the use of our intellectual property. I proposed initially that the royalty be 18 percent on all gross sales. I conceived of the idea, but Peter von Rechenberg, Martin Allgöwer's income tax advisor whom we had hired, proved to be the one who knew how to put these things in a language that conformed with business practice. He was very skilled in writing and negotiating contacts with the producers and was always careful to follow the directions we gave him. He was marvelous when it came to discussing issues with the producer. I told von Rechenberg from the beginning that the royalties that flowed into Synthes AG Chur were not for personal use but were destined to support the enterprise, so that we, as shareholders, would have no financial benefit from the organization. At first, von Rechenberg found that difficult to understand.

Synthes AG Chur would have a board of directors. The four of us: Robert Schneider, Martin Allgöwer, Hans Willenegger, and I became the four directors and controlling shareholders of Synthes AG Chur and Peter von Rechenberg became the chairman of the board. However, he was given just a nominal share in the company and made no decisions.

As a structure, this arrangement was sound, but it made one huge assumption: that Synthes AG Chur had intellectual property. Technically, it had to have intellectual property to be able to charge royalties for its use. In fact, it had none! I was the sole designer and developer of all the implants, instruments, and ideas, and I possessed all the patents for the entire AO armamentarium. Some of the instruments and implants had already been designed well before the formation of the Swiss AO and before any collaboration with Mathys. It was at this point that I decided to donate all my patents to Synthes AG Chur. This would ensure a sound financial basis for the fledgling Swiss AO to move ahead.

JS: Now Maurice, you must have realized that you were giving Synthes AG Chur a fortune. Why would you do something like that? Was it not reckless?

MEM: I had given this issue a great deal of thought. My gift of intellectual property would ensure the necessary funding for AO Switzerland for the future. This act of giving intellectual property subsequently became a standard of practice for those who belonged to AO. AO surgeons voluntarily transferred new intellectual property that they developed to Synthes AG Chur to ensure the growth and welfare of the group and its common goals. Synthes AG Chur was designed in such a way that we, the surgeons on the board would retain guidance and full control of our funds and their distribution, never for personal use, but only for research, teaching, and development.

Fifty shares were created for Synthes AG Chur. Since I had given all my intellectual property, the group wanted me to have most of the shares. I decided, however, to have only fourteen shares. Martin Allgöwer, Hans Willenegger, and Robert Schneider were to have twelve each. The group urged me to take more shares, but I told them that as long as I had fourteen and the support of at least one of them at any time, I would have the majority and the deciding vote. That was enough for me. This arrangement worked out extremely well for the next twenty years, until 1978 when Robert Schneider, who always voted with me, retired. I had always been able to count on Schneider's support and in this way, I could retain full control over Synthes AG Chur and over the financial matters of the AO. The group acknowledged that I was the one who understood business and decided that I should make all the business decisions. Martin Allgöwer was more interested in research and teaching, as was Hans Willenegger. We worked very closely together. Martin and I spoke on the phone almost daily and we never disagreed. The others also recognized my superior business talents and left these decisions to me. Peter Von Rechenberg helped, but I made the decisions, while keeping my colleagues well informed.

"I was the sole designer and developer of all the implants, instruments, and ideas, and I possessed all the patents for the entire AO armamentarium... It was at this point that I decided to donate all my patents to Synthes AG Chur. This would ensure a sound financial basis for the fledgling Swiss AO to move ahead." MEM

Once we established the separation of licensor and licensee, it was decided that the surgeons would oversee all medical issues and the producer would look after manufacturing, distribution, and sales. This was an essential separation, one which in the years to come was tested and would lead to conflict, when the AO faced a collision between the producers' commercial interests and the surgeons' medical pursuits. However, it is fair to say that for at least the first twenty years, as the number of Swiss AO surgeons and the international AO surgical community grew and the producer's sales expanded, the AO remained a model of a cooperative effort between medicine and industry. Each side respected the other and made certain that it did not interfere. Unfortunately, this balanced partnership was tested in the early 1980s when the AO Foundation was formed, and the producers were given seats on the foundation's board.

The formation of the Technical Commission (TK): 1961

MEM: I was always interested in outcome studies. That is why, from my earliest days, I pursued documentation, classification, and most important, I made certain that I analyzed the results of everything I did. The outcome was the essence of my work. If the result of a procedure did not improve the patient, it made no sense to repeat it. Outcome, particularly as it serves the patient, is closely tied to quality control.

To ensure quality control, I created the Technical Commission (TK). No Synthes product was to be sold without having been thoroughly tested first in our clinics. The stamp of the TK would ensure the safety and efficacy of all Synthes products. My friends chose me to be the chairman of the TK, a position I held from 1961 until my retirement from the commission in 1987. At first, our meetings were informal. We met socially and took time to discuss our scholarly affairs. We talked shop! It was at this point that all of us recognized the importance of our close friendship and almost brotherly feelings that allowed us to speak candidly in front of each other about all the cases we had done and all the mistakes we made (**Fig 27**). We rapidly recognized the tremendous value of the TK. It was not only quality control but also allowed free discussion and free development of

"To ensure quality control, I created the Technical Commission (TK). No Synthes product was to be sold without having been thoroughly tested first in our clinics. The stamp of the TK would ensure the safety and efficacy of all Synthes products." MEM

Fig 27 Maurice and colleagues at one of the very first TK meeting.

ideas and principles. In the eyes of the surgeons and in the eyes of our commercial competitors, it was the TK which came to stand for the excellence and safety of Synthes products. My friend Schneider used to say that each failure is important, that each must be studied and fully understood. If something proves to be a failure because of a problem with our technique or even more important, our principles, careful analysis must be undertaken and appropriate changes made so as not to repeat it. We enjoyed unity of spirit, purpose, and execution.

My chairmanship of the TK allowed me to maintain similar control over development and changes to the AO armamentarium and treatment. This remained unchallenged for almost the first twenty years, until the appearance of the locking intramedullary nail. The fiasco that developed over this implant led to my first defeat after two decades of unchallenged leadership.

Maurice's success in St Gallen

JS: Now that the first AO course was over, you had to return to your duties in St Gallen.

MEM: As soon as I returned to St Gallen, I became busy with preparations to open the clinic at the beginning of January 1961. A great deal of time had been spent training my new chief residents and assistants in the AO philosophy and techniques. Once the first AO course was over, I began to concentrate on the development of the clinic. I had promised Dr Oberholzer that I would rapidly fill a large part of the 200 beds which had been put at my disposal.

I worked to perfect the organization of the clinic. Each procedure was carefully timed; then the operating lists and nonemergency admissions were designed to fill the available time according to the length of each procedure. We were able to do 900 surgeries each year. I was ambitious and in good health. I got along with my staff, who helped greatly in achieving the perfection of the clinical machine that I developed. They felt honored to be members of my team. We met twice a day for rounds: at 7:00 a.m., to go over all the admissions and x-rays of the work done the day before, and again at 5:00 p.m. for presentations of subjects and academic training.

Each Sunday about thirty to forty fractures required admission through our emergency department. By the summer of 1961 the hospital was full. Only 10 percent of the patients were trauma cases; 80 to 90 percent had orthopedic problems. Suddenly, all the influential families of St Gallen wanted to have me as their surgeon.

There was a difference between public and private patients. Among the public patients, there was a much higher percentage of trauma, about 50 percent From the beginning, I had a large number of infected cases. There was an entire floor of patients with sepsis. You must realize what was happening. Even though we did not release the new AO instrumentation until 1963, except to those who had attended an AO course, many general surgeons were jumping on the band wagon. They began to operate on fractures even though they had no idea what they were doing. I had to deal with their failures and complications. Despite this we pressed on. The large number of septic cases made us aware of the great need to educate the surgical community.

During our first year in St Gallen the clinic developed an unbelievable reputation. Imagine, almost from the day we started, whenever I looked over my shoulder there were at least five visitors straining to see what I was doing. Many of them came from abroad. This was a most unusual event in Switzerland in 1961. Even the Canton Hospital in Zürich asked me to come and operate on their very difficult cases.

By the end of January, I went to see Dr Oberholzer to plan the visit of the authorities who were going to visit the clinic in mid-February 1961. When I began to discuss the visit with him he asked,

"Why do you need a program? During the last month, the hospital has been so full that we have been having a real problem finding beds on weekends for cases of ski trauma. Things are also happening that we have never seen before. Only one third of the patients are from Canton St Gallen. Everyone is talking about this miracle. You don't need to invite the authorities. They know all about it."

The citizens of St Gallen had started to complain that there was no room for them in the clinic, that they had to wait to be admitted for surgery. They regarded the patients from other parts of Switzerland as foreigners. In Switzerland, anyone outside one's canton was a foreigner. Furthermore, the clinic began to fill with patients from adjacent countries, like Austria, Germany, Holland, France, and Italy. I was particularly famous in Italy, where I had done osteotomies of the femoral neck for slipped capital epiphysis, an operation no one else dared to do because of the high complication rate, and intertrochanteric osteotomies for coxarthrosis. Since I had also traveled and lectured in the United States, patients, like the uncle of Dr Herbert Sandick, came from overseas. On February 9, 1961, I implanted a hip of my own design, which was the first total hip replacement on the European continent, Soon after, patients began to come seeking treatment for their diseased hip joints.

"On February 9, 1961, I implanted a hip of my own design, which was the first total hip replacement on the European continent. Soon after, patients began to come seeking treatment for their diseased hip joints." MEM

The idea of establishing an academy in St Gallen

MEM: The clinic in St Gallen was successful and busy. It was rapidly gaining local, national, and international renown. But I was still making plans. I was always trying to find better ways of organizing and doing things. I had a habit of waking up in the middle of the night and scribbling my dreams and thoughts on scraps of paper. The next day I would look at what, at night, seemed certain to win the Nobel prize. Organization and planning were my obsessions.

[This seemingly innocent remark encapsulates one of the main drives of Maurice. He never stopped, even for a minute.]

Martin Allgöwer and I were jockeying for future positions. At that time, there were a few who were "the famous young surgeons" in Switzerland. Because Switzerland is a small country, everyone knew what everyone else was doing—even what they were thinking. Martin, with whom I had become close friends, took the job as chief in Chur in 1956. He had been Professor Nissen's chief resident in Basel. In 1951 and 1952, he took time off to spend a year doing research in Texas, after which he returned to Basel to continue as chief resident. He did not get along well with Professor Nissen, and to prove that he could run a large clinic, he moved to Chur to be chief of surgery. With time, he would become the natural successor of Nissen but he had to wait until 1967 when Nissen retired.

When I took over at St Gallen hospital, I thought I would likely remain there until at least 1968 when Professor Francillon was due to retire. There was also a possibility of a position in Basel and one in Bern, but the latter would not materialize until 1967. Thus, when I was considering St Gallen, I had discussed my future with Martin. We had talked about various possibilities. Since neither one of us had a university job, we got the idea that it would be great if we started our own medical university in St Gallen. It was a university town, although it did not have a medical faculty and did not teach science. We hatched a concept to start an academy. An academy would be an institution responsible for training doctors during their clinical years. It would not have any of the basic disciplines like anatomy, physiology, or chemistry.

Martin Allgöwer was excited about the idea. We also planned that if the academy were to succeed we would move our resources from Davos and consolidate everything related to the AO under one roof. Martin was originally from St Gallen; the idea of returning home was appealing to him. Martin planned to apply for the position as chief of surgery, since Dr Oberholzer would retire in 1962. We were also able to get commitments from some companies that were interested in supporting the concept of an academy.

Finally, of the two finalists for the position in St Gallen, Martin Allgöwer and Markus Angwerb, the search committee recommended the appointment of Martin to the post. Then, as rumors began to circulate about his appointment, the citizens began to protest. St Gallen, both the city and the canton, were strongly Roman Catholic. Most recent positions in the hospital had been filled by Protestants, including mine. But the community paid no attention to academic qualifications. Since the retiring chief Dr Oberholzer was a Catholic, they insisted that another Catholic had to be appointed. Zürich University also supported the other candidate. Martin was perceived to be using the job as a stepping stone for his preferred appointment at Basel. The position was given to Markus Angwerb who was Catholic. Martin stayed in Chur until he went to Basel in 1967.

When the appointment of Martin Allgöwer was blocked, it became clear that the proposal to establish an academy in St Gallen would collapse. This had serious repercussions for the medical staff of the hospital. There were chief residents in other disciplines in St Gallen who were excellent. One of them, Dr Alfred Bangerter, an ophthalmologist, who was the brother-in-law of my sister Violette, was very well known. Martin's appointment had been anticipated with enthusiasm, as he had become famous in Switzerland, but with the failure of the plan for an academy, many of the talented chief residents left to pursue academic careers elsewhere. I began also to examine my future. I could continue working in St Gallen where I was becoming famous doing work that was truly world-changing. However, without an academy, St Gallen would never become an academic center. All that I could hope for was to become a professor extraordinarius, which was not what I wanted. I wanted an academic career and I knew how important that would be for our newly established AO group. I had to explore what was available elsewhere.

Decisions were also being made in the field of general surgery. When the professor of general surgery at the University of Zürich was about to retire, there were two surgeons in Switzerland who were eligible for the job: Martin Allgöwer, who was in Chur and Hans-Ulrich Buff, who had been chief resident in general surgery at the university, after which he became chief in Solothurn in 1952, where he would await his opportunity for Zürich, just as Martin was awaiting his in Chur. When the time came to replace the professor of general surgery, the University of Zürich decided to divide the position by appointing a cardiac surgeon from Stockholm as professor of thoracic and cardiac surgery and a general surgeon as chief of visceral surgery, who would look after mainly abdominal surgery. Both Martin Allgöwer and Hans-Ulrich Buff applied for this position. Buff was chosen; he became the professor of visceral surgery at the University Hospital in Zürich.

Maurice's options

JS: Maurice, what did you do when it became clear that your idea for an academy for St Gallen would not be realized because Martin Allgöwer was not appointed? What was your reaction?

MEM: Well, I never regret. It doesn't help. What I do is consider the options and then do what I think best and move forward.

[This statement characterizes what sometimes seemed puzzling about Maurice's attitude; sometimes it appeared that he gave up without a fight. However, the truth is that Maurice chose his battles. In the many struggles he faced over the years, he would fight against all odds when he thought he could win. If he realized that there was little or no chance to turn things around, he would walk away. In Maurice's view, if a loss is certain it is better not to fight and give the opposing side the satisfaction of winning. Even though St Gallen was very successful as a hospital, it ceased to be challenging for Maurice when he realized that he could not establish an academy.]

JS: What other positions were available?

MEM: There were only two possibilities for an immediate change: Basel or Bern. As far as universities were concerned, aside from Zürich, there were only Lausanne and Geneva. I could not consider Lausanne because of its attitude to fracture treatment. The general surgeons there would not have given up their control over trauma. It would have taken at least five years to get it away from them. Geneva would have been a waste of time, since it had a tradition of appointing only natives to positions of seniority. The man destined to be appointed to Geneva was Taillard, who had worked under me as an assistant at Balgrist. When I was leaving Balgrist in 1957, he was moving to be an assistant in Basel, where he planned to wait for his inevitable chance to be appointed in Geneva. Taillard was a superb politician; he was carefully planning his future. While still in high school, he had the nickname "professor."

I went to look for a job in Basel, where there were two surgical clinics. Dr Hauser was surgeon-in-chief at the Felix Platter Hospital, where Debrunner[1] was the orthopedic surgeon. Since Debrunner was retiring, I decided to apply for his job because a new Felix Platter Hospital was being built. In the new hospital, general surgery and orthopedics would be divided. Although Debrunner lived in Zürich while working in Basel, his replacement would now have to live in Basel.

I met with Professor Nissen, a powerful man who made the decisions in Basel. He had not liked the fact that I had done surgery for Dr Hauser between 1957 and 1960 and because I was introducing new and controversial ideas. He was also uneasy about me because I had trained at Balgrist; among general surgeons Balgrist had the reputation of being a home for cripples and was considered a poor surgical training center. When I was being interviewed, Nissen already had another candidate in mind, a surgeon from Holland, who had published many papers. However, I knew that he did not know how to operate. He proved to be a disaster.

[Here is another example of the importance Maurice placed on technical prowess. He thought little of surgeons who did not have his gifts. He always felt that his surgical wizardry was the key to his success and a very important talent for every surgeon.]

MEM: At the interview, I pointed out to Nissen that I was head of a large clinic of almost 200 beds. Basel was a much smaller place. I wanted to continue to work in St Gallen until the new clinic was built, but that was a condition Nissen was not prepared to accept. He thought I was stupid and obstinate to turn down the offer. After my interview, I was sure that I would not regret turning down the appointment in Basel. Basel was very German, and for me listening to Basler German would have been more than I could tolerate.

1 Hans Debrunner (1889–1974) taught orthopedics at the University of Basel from 1948 to 1959.

At about the same time in early 1963, I noticed an advertisement for a position in Bern. I was hesitant about applying because of the way surgery was organized there; trauma and orthopedic surgery were divided. That meant that trauma would remain in the hands of the general surgeons under Dr Lenggenhager. I remembered Lenggenhager from the brief time I was a student in Bern in 1940, the year he became professor. He was a favorite with the students; he spoke very well and knew how to appeal to young people. By 1963 he had been in the position for twenty-three years. Dubois, the orthopedic surgeon, represented the old school. He had trained at Balgrist during the First World War and was appointed to the job in Basel in the early 1920s. By 1963 he was an elderly man and ready to retire. It was his retirement which opened a position in Bern.

Up to the point of this new advertisement, trauma cases had been divided between the two surgeons and two institutions: Lenggenhager at the university clinic took trauma cases for two weeks and Dubois, who worked at another hospital, took trauma for one week. Lenggenhager's was the primary clinic and Dubois' clinic was secondary. Even though Lenggenhager and Dubois, who was a full professor, were members of the faculty council, it was Lenggenhager who was the more powerful. As you recall, orthopedic surgeons did not have that much of a profile in Switzerland at that time; most general surgeons considered that the main work of orthopedics was looking after crippled children, as they did at Balgrist.

Dubois was about to move into a new hospital, the Insel Hospital, which was in the process of being built in Bern. While awaiting the final move to the new building, Dubois had moved his department temporarily into a new pavilion. During this period, Dubois' clinic was being reorganized; it was to be divided into urology and orthopedics. A new chief of urology had already been appointed. Dubois' successor would ultimately become professor and chief of orthopedics. It was widely assumed that Dr Max Geiser, an orthopedic surgeon who was Dubois' chief resident, would become his successor. I learned that Geiser had already drawn up plans for the new orthopedic clinic. He thought that the job was going to be his, but for the appointment to be legal, it had to be advertised. Since it seemed I had little chance, I did not apply.

However, Dr Franz Escher, the dean of the medical school in Bern and an important figure in the city, was a friend of mine. We had been in the same medical fraternity and took ski holidays together. Suddenly, days before the deadline for applications, Escher phoned to ask me to apply for the position. I explained why I was not interested. He called a second time to ask if he, together with a representative of the government, and the director of the new Insel Hospital, who was acting as the representative of the faculty, might come to see me about the job in Bern. Again, I mentioned that I was not interested, but the dean said that they were going to come just the same. He was very determined. The three appeared two days before the deadline for the application. They now appealed to me as a Berner, who had studied in Bern. In fact, Geiser was much more a Berner than I. I had studied in Bern for only a short time. My father's roots were in Canton Zürich, and my mother came from Neuchâtel. It is true that I was from Canton Bern, since I was born in Biel, but Geiser was a real Berner, a citizen of Bern, who had done all his studies there.

Despite this, they insisted on knowing the conditions that would make me reconsider. I said that first I would not move to Bern until the new hospital was ready. I would remain in St Gallen and commute to Bern. During the new Insel Hospital's construction, I would agree to work in the provisional pavilion, the temporary housing, where Dubois was now working together with his chief resident Dr Geiser. I would occupy the pavilion together with one of my chief residents from St Gallen, and that two of us would run the division of orthopedic surgery. I would come to Bern for two days a week, during which I would give lectures, run an outpatients' clinic, and do a surgical list. The outpatients' clinic would be held on Thursday mornings. At midday, I would give two-hour lecture for the medical students. Surgery would be on Friday, so that on Saturday I could be back in St Gallen to do the weekly grand rounds in my clinic. I said I would attend the faculty council in Bern which met twice a month on Wednesdays. The dean was willing to accept these conditions. I then said that there were two more: I would take the position only if I were appointed to the rank of ordinarius[1] professor of the locomotor system and director of orthopedic surgery as of 1963.

JS: What aspects of the position in Bern appealed to you?

MEM: I knew that I could count on having the position at Balgrist when Francillon retired in 1968, but I would be getting an old Balgrist, while in Bern I would be getting a brand-new clinic, which would be built entirely to my specifications. I also realized that despite being chief, I was still a stranger in St Gallen. My family had moved there with me, but we were foreigners. I was a Welscher. In Zürich, I would be on the border between the French and German Switzerland, but in Bern I had childhood friends and I was only twenty minutes from my home in Biel. I also had enemies in Zürich, like Buff, and there was also a possibility that I would not get the position. My wife was also a Berner. She felt much more at home in Bern. Bern was indeed very attractive, but the search committee had to agree that I could stay in St Gallen another four years until 1967, when the new clinic would be finished.

In the two days before the deadline for the applications, I decided to accept the offer to go to Bern. However, a problem suddenly became apparent: a clique among the faculty in Bern insisted that Geiser be appointed. The work on osteogenesis that he had done under Trueta was considered a great strength. The dean recognized the political problem. He told me to give a lecture to the faculty to win them over.

1 Ordinarius represents the highest rank at a German university: a professor who occupies a chair with control over the teaching of his subject and a role in the government of the university. Extraordinarius is the title given to a professor without a chair. It is somewhat comparable to associate professor in North America.

I was prepared to give a lecture on osteogenesis with illustrations that we had prepared for the book we published in 1963. I also had the results of new experiments which had been done by Robi Schenk.[1] I also had the work of Heinz Wagner[2] on bone formation under pressure. Nevertheless, the lecture was a great challenge. I would be speaking about pressure osteogenesis to a crowd that believed that pressure would cause bone necrosis and resorption. Despite this, I was confident that I would astonish the audience with things they had never seen or heard.

First, Geiser gave a beautiful lecture on osteogenesis, but his views and work were old, conventional theories. When my turn came, I became an instant champion. The faculty was intoxicated with the hope of a future that I personified. The result was that all my conditions were accepted. They were even willing to scrap the designs for the new clinic that Geiser had made and accept mine. Geiser's plans for the orthopedic operating rooms called for a large operating room with two tables. I considered this to be madness for a new orthopedic hospital. My plans called for one building to accommodate the new operating rooms, the emergency department, and the new research facilities, and another to house patients. The new orthopedic operating rooms would have a clean laminar airflow room for arthroplasties, one large orthopedic operating room for other major procedures, and two smaller ones for simpler surgeries. It would connect with the patients' building by means of a common corridor on each floor and a staircase. I also planned a separate septic floor with its own operating room and ward. I suggested that Professor Lenggenhager and I share trauma until his retirement. He would remain in charge of trauma, but I would take charge of fracture care. After he retired, all polytrauma would come to orthopedics. I worked part-time in Bern from 1963 until April 1967, when I became full-time.

Geiser was terribly disappointed. Both Dubois and Geiser were very much opposed to the new AO and me. They had declared their opposition during the special meeting of the Swiss Surgical Society in November 1960. Geiser was in favor of conservative, closed treatment of fractures and, in addition, there was personal jealousy between us. Besides our philosophical differences, both Dubois and Geiser were orthopedic surgeons like Francillon. Part of the orthopedic community's opposition to AO was that they did not want to treat fractures, since it would involve emergency work.

"Part of the orthopedic community's opposition to AO was that they did not want to treat fractures, since it would involve emergency work." MEM

1 Robert K Schenk (1923–2011) became professor in the Faculty of Medicine at the University of Basel in 1956, where he taught anatomy. In 1971, he became professor of anatomy in the Faculty of Medicine of the University of Bern and vice-director of the Anatomical Institute.

2 Heinz Wagner (1929–1972) was chief surgeon in the Orthopedic Clinic in Altdorf near Nürnberg in 1966. In 1969 became professor of orthopedics in the Faculty of Medicine, University of Erlangen.

The creation of the Protek Foundation in 1965 and Protek AG in 1967

MEM: The years 1963 to 1967 were busy. I was still running the clinic in St Gallen. As well, we began to write the new AO Manual. Although it had been agreed that we would share the load, once it came to the actual writing, I found that I did most of the work. I was also very busy with Protek AG, which I founded in 1965. This was a firm which I established to look after the production and sales of my total hip prostheses and related instruments. I had implanted many new hips, which were manufactured for me by Mathys from stainless steel. Later in 1964, I changed the material to cobalt chrome and signed an exclusive agreement for the manufacture of Müller "originals" with Sulzer.

In 1960, when we signed the contract between Synthes AG Chur and Mathys, I had insisted on a special clause, which excluded everything associated with my work in hip surgery, such as the manufacture, distribution, and sale of my hip products. This exclusion was added again when we signed the new contract between Synthes AG Chur, Mathys, and Straumann in 1963.[1] My hip work would be separate and independent. As my fame as one of the pioneers of total hip surgery began to spread, sales of my prostheses and related instruments began to rise at an alarming rate. Initially, my sister Violette oversaw all the sales, but it soon became apparent that we needed a more sophisticated arrangement. I felt strongly that the income from the sales had to be kept separate from my surgical income. I borrowed from my design for the AO, which I made in 1960, and established the Protek Foundation in 1965 with its office in the Canton Fribourg, just outside the city of Bern. The office of the foundation, as well as that of Protek AG, which looked after the sales and distribution of my products, was in the old Lindenhof, a private hospital which was slowly being vacated as a new building was being constructed. I signed a contract with Sulzer, the large engineering and manufacturing firm in Winterthur, which made it the exclusive manufacturer of my prostheses and implants. Sulzer would deliver its products to Protek AG, which would pay a royalty to the Protek Foundation on all the sales. This became my source of funding for further research and development projects. It had nothing to do with AO nor with Synthes AG Chur. The only link was that I appointed Peter von Rechenberg as president of the Protek Foundation, to replace my sister Violette. Mr Marcel Madl became my trusted business manager and the accountant of Protek AG.

1 Institut Straumann AG, Waldenburg, Switzerland became a leading manufacturer of osteosynthesis implants from 1970 to 1990.

Designing hip replacements

JS: Maurice, you were a pioneer in hip design and implanted the first total hip on the European continent on February 9, 1961. How did you proceed with this aspect of your work?

MEM: Over the years, I thought a great deal about the design of a total hip. I had not forgotten the arthroplasty patient I saw during my locum in Bern in 1944 and I also had done a review of arthroplasty patients while in Holland in 1950 with Van Nes. Since he had been trained in Boston, he used the Smith-Petersen cup for patients with arthritis; for those without a femoral head, like patients with avascular necrosis secondary to trauma, he did the Judet arthroplasty. As chief resident at Balgrist I had done several Judet arthroplasties, particularly for patients with fractures of the femoral neck where the head had died. I had also operated on a few patients with osteoarthritis. I knew about Smith-Petersen's cup arthroplasty, but I had never done one. There were other surgeons working in England on the problem of total hip replacement. One was Peter Ring,[1] who was working on a metal-on-metal prosthesis and another was being introduced by McKee[2] and Farrar[3] in Norwich. It was a combination of a Smith-Petersen-like cup and a Moore-like femoral component, also a metal-on-metal prosthesis.

In Fribourg in 1951, I did some hip arthroplasties, but I was much busier with trauma. During my five years as chief resident at Balgrist, I concentrated on hip surgery, since I decided that the thesis for my PD would be in that area. My favorite operation was the varus Pawels' intertrochanteric osteotomy. However, for patients with posttraumatic avascular necrosis, I did the Judet arthroplasty. During my three years as an itinerant surgeon, I performed many intertrochanteric osteotomies, occasionally osteotomies of the femoral neck for cases of slipped capital epiphysis, and sometimes Judet arthroplasties.

The subject of hip arthroplasty was very much on my mind. We were on the brink of the development and clinical application of total hip replacement. The operation was so to speak "in the air." My own idea was that procedures in which the components were not fixed were likely doomed to failure. In 1960, I heard from an old friend Dr Wilhelm Zinn, the rheumatologist from Bad Ragaz who owed his training and profession to me because I suggested that he apply for the job in Zürich that I was turning down. He told me that he had traveled to England in late 1959 and attended lectures given by John Charnley from Wrightington. He reported that Charnley was using Teflon for his socket and a 22 mm head for his monoblock femoral component which was made from stainless steel. He also mentioned that Charnley was cementing his components using dental acrylic.

1 Peter Ring (b. 1922) was the Evans Lowry Professor at the Royal College in London in the 1950s. He moved to Redhill in Surrey to found a fracture clinic and an orthopedic and trauma service.

2 George Kenneth McKee (1906–1991) was appointed consultant in orthopedics at the Norfolk and Norwich Hospital in 1939.

3 John Watson-Farrar (1926–1999) was consultant orthopedic surgeon at the Norfolk and Norwich Hospital, a post he held from 1965 to 1986.

My first idea for a total hip design was to use stainless steel for the femoral component. I chose a head of 24 mm. Mathys made the prosthesis. For the cup I used polyester, a compound similar to Teflon. This was the design for the first hip I implanted in February 1961. These first cases left me with the impression that we were well on the way to having an answer as far as hip arthroplasty was concerned, although I had concerns about the materials used: stainless steel for the femur and plastic for the socket. While I was still at Balgrist, I believed that arthroplasty components would have to be fixed but stupidly, when I started to fix them, I was under influence of the early experiences in America. I used Ostamer, the "magic" bone glue, that was popular in the United States. At that time, I had no idea that Charnley was already using dental acrylic. When my first case began to loosen, I realized my error. All the cases in which I had used Ostamer had to be revised within six months because of early failure. Once I heard from Dr Zinn in 1959 about Charnley's glue, I immediately abandoned Ostamer and switched to a dental acrylic which I obtained from my dental friends. Thus, by 1961 when I implanted my first total hips, I was using a dental acrylic. The early cases from 1961 to 1963 did well, although I had already had the first stem fracture in 1962. This led me to the first modification—a thickening of the stem.

"By the time Charnley came to Switzerland as guest of the second AO course in Davos in December 1961, I had already implanted thirty-nine total hips." MEM

By the time Charnley came to Switzerland as guest of the second AO course in Davos in December 1961, I had already implanted thirty-nine total hips. I had only one type of implant, which I continued to use until 1963. I also showed Charnley the tissue culture studies, which we used to study the tissue tolerance to the materials. He was most impressed.

Other colleagues in Switzerland were also interested in designing hip replacements. In 1962, after training at Balgrist, Arnold Huggler[1] went to visit John Charnley. When he returned, he designed another total hip replacement which he implanted in Chur at the hospital where Urs Heim[2] was surgeon-in-chief. Hardi Weber, my chief resident in St Gallen, was also interested in this subject. He was an extremely talented surgeon but had a very short temper, which resulted in his having to leave Balgrist suddenly in 1958. He left Switzerland and got a job in England as chief resident with John Charnley. After a while he longed to return to Switzerland and implant a total hip of his own design. When we began to work together in St Gallen he showed me his design. I told him that I thought the concept was wrong. In his design, the cup was metal, as was the stem, but the stem had a trunnion, on which was mounted a large polyethylene sphere which articulated with the cup. Therefore, his hip had two articulations: one between the trunnion and the other being the large head with the metallic socket. While we worked together at St Gallen, I never allowed him to implant a hip of his design, but when he took over as chief after I left in 1967, he began using his total hip. Although I was not there as a witness, I heard that he had to revise many of his cases because they failed. In those days, there were no rules governing what implants one should be allowed to use. We knew so little about the principles of total joint replacement that the opinions of leaders were quoted as scientific truth and were followed as such. We were still experimenting with design materials and fixation.

1 Arnold H Huggler was chief surgeon in the Kreuzspital in Chur.

2 Urs Heim (1924–2013) was chief surgeon at the Kreuzspital in Chur from 1961 to 1981. After 1981 he was in private practice as a hand surgeon in Gümligen. From 1988 to 1993 he was president of AO International.

Four months after Charnley visited Davos, I visited him in England in 1962. He was still pleased with the cases in which he had used Teflon. Toward the end of 1962, he noted his first failures but kept the experience to himself. Patients had begun to return with pain. I noted the same but somewhat later. When the Teflon cases began to fail in large numbers, Charnley thought that the total hip experiment had come to an end, but then, just by chance, one of his coworkers, an engineer, had heard that a new material called polyethylene had been developed in Germany. It had ten times the frictional resistance of Teflon and would better withstand wear caused by the articulation of a metal head against it. I had made a similar observation but instead of polyethylene, I started to use a polyester. I had also started to use metal on metal in 1963. My metal-on-metal components had small polyethylene pads on the head to allow low friction during the early phase of use, but the pads wore down and disappeared rapidly. Then the metal head articulated with the metal cup. Both the stem and the cup were cemented. I used them for only a short period.

In 1963, both Charnley and I attended the SICOT meeting in Vienna. I had prepared an excellent exhibit about the early work of Willenegger and Schenk on fracture healing under conditions of absolute stability that we thought represented examples of primary bone union. I also had the early experiments of Heinz Wagner, which showed bone hypertrophy in response to pressure. During one of the social evenings, Charnley and I and our wives went to a Heurigen, a white wine festival on the outskirts of Vienna. We drank a lot of wine. Both of us became quite inebriated and ended the evening as close friends. We realized that we faced similar problems and decided to work together in using polyethylene, the new material. I also made a revision in the design of the femoral stem. I thought that the shape of this stem, which resembled an awl, would be best for cementing. I called this design of the femoral component a Setzholz prosthesis.

Our laboratory for experimental animal surgery in Davos was developing techniques for the study of materials in cell culture, which would allow us to study the biological tolerance of the material we were using. We looked at Ostamer bone cement, methyl methacrylate,[1] and Teflon. These experiments were of great interest to Charnley when I showed them to him at the end of 1961. Charnley's own experiments were mainly mechanical and concentrated on wear and friction. He had his own workshop where he tested many of his ideas.

In the United States, the use of bone cement was forbidden. The experience with Ostamer was not easily forgotten and methyl methacrylate or dental acrylic could be used only in a few clinics where it was used to cement total hip components, but only under strict experimental protocols approved by the Food and Drug Administration. All the early total hips in the United States were done in academic institutions.

1 Methyl methacrylate is a compound like dental acrylic.

My next modification had to deal with dislocation. Charnley osteotomized the greater trochanter and had a much lower dislocation rate. I thought the trochanter should be left intact, but then I had to deal with seven hips which had dislocated. To solve this problem, I increased the size of the head from 24 to 32 mm. Since a head of 32 mm made the prosthesis heavy, we drilled out the undersurface of the head to make it lighter. We felt that the hole created would also help with knocking out the stem in cases that had to be revised. It is clear that we were working in the dark and did not understand what was going on. When some of these cases were revised, we noted that the hole in the head was filled with a hard plug made of tiny particles of polyethylene. We were beginning to appreciate the wear of polyethylene but were still under the impression that the resorption we were seeing in cases of loosened prostheses was due to fracture of the cement, as well as cement particles. We mistakenly called this "cement disease."

The Setzholz prosthesis proved to be an excellent design; many have survived well beyond twenty years, but the longer, straight stem of the femoral component made exposure and implantation difficult. Surgical exposure of the hip joint had not been well worked out and the insertion of a long, straight stem created major difficulties. I was opposed to the idea of osteotomizing the trochanter. I solved the difficulty of inserting the long, straight stem by shortening it and curving the stem in the shape of a banana. Some called this the "banana-stem prosthesis." It was easy to insert through a small exposure. However, by solving one problem, I created another. The sharp edge of the inner curve of the stem led to early loosening because it caused fracturing of the cement mantle.

We progressed step by step, solving one problem after another. John Charnley's solution to the problem of dislocation while he was using a small 22 mm head was to osteotomize the greater trochanter and transfer it distally at the end of the operation. This tightened the abductors and kept the joint in place. Charnley maintained, until the day he died, that when he would manage to solve the fixation problem of the greater trochanter, he would have solved all the problems of total hip replacement. Charnley's ideas contributed greatly to the early design of stems, which began to appear on an experimental basis in the United States.

[It is fascinating today to look back on the early days of the total hip in Switzerland where designs were made without testing. Patients became guinea pigs. There were no standards and no controls. Leaders like Charnley and Müller swayed the market with their pronouncements, with their implants, and their instructional courses. In North America, a different world was developing with William Harris[1] and other leading surgeons introducing their designs. Government controls in America were much tighter; new designs had to follow strict protocols. However, the early North American studies were mostly retrospective and dealt with only short-term observation, three- to five-year follow-up. Some were longer, but still far from sufficiently long to serve as appropriate guides to safety and effectiveness. Evidence-based medicine was still in its infancy.

1 William Harris (b. 1927) was Chief of the Adult Reconstructive Surgery and Director of the Harris Orthopedic Laboratory of the Massachusetts General Hospital. He was Clinical Professor of Orthopedic Surgery at the Harvard Medical School since 1974 and was awarded the Alan Gerry Chair as Clinical Professor of Orthopedic Surgery at Harvard Medical School in 1997.

An early issue was infection. Laminar operating room airflow and prophylactic antibiotics were used to drive down the infection rate. In many North American centers, where laminar air flow installations were not available, total hips were being implanted only with prophylactic antibiotics, with infection rates equal to those in Europe. Müller fiercely opposed the use of antibiotics because he felt they were unnecessary and could lead to the development of resistant strains.

The genius of Charnley and Müller, combined with their intensive studies, provided the pioneering leadership in hip replacement. In the early days, surgeons came to work with Charnley as his assistants. A few, after studying with him for only a short period, returned to their hospitals and designed their own implants without regard for biomechanical testing or animal experimentation, in effect using their patients as guinea pigs. Most of their designs proved unsuccessful. Because of the catastrophic experience with Ostamer glue, there was tight control in North America, where total hip replacement could be done only in university centers under strict supervision. In most countries now, rigorous oversight in medical research is enforced.]

April 15, 1967: Maurice moves to Bern

MEM: I left St Gallen on April 15, 1967 and arrived in Bern to take over my full-time duties and responsibilities. I ran into terrible problems almost from the first day. In St Gallen I had a clinic of almost 200 beds. I was initially promised that the new Insel Hospital would have eighty adult beds and twenty beds for children. However, there were only seventy beds and a few pediatric beds. As far as the children beds were concerned, they said that the children did not want to leave the children's hospital. It was a lame excuse.

"The genius of Charnley and Müller, combined with their intensive studies, provided the pioneering leadership in hip replacement." JS

In Bern, five operating rooms had been planned by me: one with laminar airflow for arthroplasties, two normal operating rooms, and two smaller rooms for small procedures. Initially, the building program was behind schedule and the facilities were not ready. In the meantime, we used the operating rooms meant for general surgery. There was, however, a much greater problem that became apparent immediately—the matter of efficiency in the management of the operating rooms.

In St Gallen, every operation was booked according to the average time for each procedure. All patients were anesthetized in an induction room next to the operating room, while the operating room was cleaned. The anesthetists were responsible to the surgeon. In Bern, I ran into a system that proved to be an insoluble problem. The operating rooms were run by the department of anesthesia. Productivity was a concept they did not understand. The culture in the new Insel Hospital was even worse than it had been in the pavilion where I had worked part-time since 1963. The anesthetists decided where to put the patients to sleep and on the type of anesthesia used. The result was an impossibly slow turn-over time. I could not get anything done.

When I first came to Bern before the new Insel Hospital was built, Professor Lenggenhager would sent difficult trauma cases either to Allgöwer in Chur or Willenegger in Liestal. He did this out of spite because he could not forgive me for the fact that I took the position that he had hoped Geiser would get. Lenggenhager compromised when I moved to Bern in 1967. He became the chief of trauma and I became the chief of fracture surgery. Sometimes it was cumbersome, but it was a solution which allowed him to preserve face. He worked until 1971. He died soon after his retirement in 1976.

As head of orthopedics, I was appointed chair of the search committee for his replacement in 1972. I had no vested interests and could be impartial. One of the candidates, Dr Berchtold, who was chief of surgery in Solothurn, was my unofficial first choice, but the second choice of the search committee. In the end the committee's first choice took a job as chief in Geneva. His wife was from Geneva's nobility and would never have moved to Bern. With this, Rudolf Berchtold became chief. He was a member of the AO. From that day on, general surgery and orthopedic surgery cooperated smoothly.

Ordinarily a "primarius," a university professor and head of department, operated only at the university hospital, but I had insisted, as a condition of my taking the position, that I be allowed to operate in a private hospital. My solution was to start operating in the old Lindenhof, a private hospital. The new Lindenhof was ready in late 1966. At first, I could have as many beds as I wanted. As a private hospital, the Lindenhof was dependent on the surgeons bringing patients to the hospital. Initially, the new Lindenhof did not have many surgeons who had private patients. Later, I funded the addition of a laminar airflow clean room in the building where we did all the total joints and in return, I was allowed as much operating time at the Lindenhof as I wanted. Since the hospital had no age restriction for surgeons, I was promised access to the operating room for as long as I wanted.

In St Gallen, I had two chief residents. At the new Insel Hospital I started out with three: Dr Christoph Meuli, Dr Debrunner[1], and Dr Boitzy who moved with me from St Gallen. Reinhold Ganz started with me as an assistant in 1969 and became chief resident around 1975.

JS: When you arrived at the university and settled your staff and resources, what was your vision? What did you want to accomplish?

MEM: The first thing I realized in Bern was that I would have to cut back my surgical practice. That meant that care for public patients would be restricted because the operating room could not run efficiently. I had not realized that this was the culture of an academic institution; I found it difficult to accept, since it meant a waste of resources and manpower. The next thing I realized was that I would need a couple of years in this new place until I figured out what to do. The day I came to work full-time, they asked me to join the building committee. This was my first experience with a committee in an academic setting. We talked, we made decisions, we made recommendations, and it took forever for something to happen. Then you must realize, I came in 1967. In 1968, there was the student revolution. When I started in Bern on a part-time basis in 1963, I had to give students 180 hours of instruction in musculoskeletal disorders. With the student revolution and the changes that followed, the schedule for lectures was cut to sixty hours. It was an impossible reduction. I was very ambitious at the beginning, but reality was setting in.

At the university, a man by the name of Dr Pauli was in charge of education. He started as a chief resident in internal medicine. Then he got a PD. In 1968, he and all the chiefs suddenly thought that they should be leaders. Since he was from Bern and knew his way around, Pauli became the chairman of the education

1 Alfred Debrunner (b. 1929) became the chief of the orthopedic department in the Triemli City Hospital in Zürich in 1970.

committee. He thought that orthopedics was a simple field and would not need even the sixty hours allotted under the new rules. I was not happy that each chief would be a teacher. I felt that ability should dictate who should be a teacher. I could not function in this new system, so I turned to the clinical vice-director of the New Insel Hospital, Mr Fritz Leu. The director was Dr François Kohler.

The beginning of Murtenstrasse 35

MEM: I had spoken with Mr Leu already in 1968 about the difficulties I was facing. Around the beginning of 1969, he came to see me. Leu said that the university was anxious that I should take time and learn how things worked. They were afraid that I would make mistakes. I told Mr Leu that I thought Dr Pauli was not very wise and that there was no point trying to discuss anything with him. I shared my ideas about education with Mr Leu and I told him that in my view, we had to do something else. To this he replied that the hospital and the university had indicated that if we could find money to buy land for a new building, I would be able to do all I wanted. Mr Leu advised that we should put our resources together and build a new academic house that the university and I would share.

I put up one million Swiss francs to buy the land. The cost of the new building would be shared equally between the Insel Hospital and the university. The university agreed to repay the one million francs I gave over a period of ten years at 100,000 francs per year plus 5 percent interest. However, I suggested that it be repaid over twenty years and that the repayment should be used to pay for my occupancy. This meant that I could use four floors rent-free over that period. With my private funds and with the help of the Protek Foundation, I bought the land and put up the money. The university and the hospital built the building, which became Murtenstrasse 35. The house was completed in 1975. Until this time, there had been poor coordination between the university and the Insel Hospital. Now they had a shared enterprise. I remember that we first used the facility in February 1975, when I hosted the Dewar Club, a group of orthopedic surgeons from Canada. We were able to put on a great show with direct video and voice transmission from the operating room of the new Insel Hospital. Each visitor could connect directly with the operating surgeon. The Canadians said that they had never seen anything like it.

I could now move into the top floor of Murtenstrasse 35, where I located my personal office, all my hip documentation, the AO fracture documentation, and the office of the Protek Foundation, which up to that point had been in the old Lindenhof Hospital. On the same floor I built a new, modern lecture room with money from Protek AG because we were going to use it for hip courses which would benefit the firm. It was the most modern teaching facility in Switzerland, if not in Europe. It was available to both the university and me. The other three floors that belonged to me were used for research in biology and biomechanics. Funding these became extremely complicated. Drs Fleisch[1] and Preisig[2] received some funding from the government. In the end, I can say that Murtenstrasse 35 began to function as my own university.

1 Herbert André Fleisch (1933–2007) was director of the AO Laboratory for Experimental Surgery in Davos from 1963 to 1967. In 1969, he became professor and chairman of the Institute for Pathophysiology at the University of Bern, where he remained until 1997. From 1980 to 1983, he was Dean of the Faculty of Medicine in Bern.

2 Rudolf Preisig (1929–2017) later became the founder and director of the Institute for Clinical Pharmacology at the University of Bern.

I had one problem integrating Protek AG, which could not be part of Murtenstrasse 35 because it was a commercial enterprise. Its offices occupied a different building not far away. Up to that point, the Protek Foundation was under the presidency of my sister Violette and was registered in Canton Fribourg in a village near Bern. When all my enterprises had moved into Murtenstrasse, we changed the name of the Protek Foundation to the M.E. Müller Foundation of Switzerland. It was a complex organization with its own board of directors and an executive secretary. Its office was also in Murtenstrasse 35.

AO: continuing development

JS: Maurice, how did the AO develop further to become a worldwide success story?

MEM: The creation of AO clinics was crucial to the success of the AO. My clinic in St Gallen became one of the largest and best known orthopedic and trauma clinics in Europe. It became a mecca for patients, as well as for many surgeons from Switzerland, from all over Europe, from North America, and elsewhere. Soon, the other AO clinics began to attract visiting surgeons; they could travel from one AO clinic to another, observe the unity of concept and principles, and see the early results of treatment. Some stayed as fellows and took our principles and methods back to their centers. This openness was novel. In most clinics, surgeons worked alone.

"A very important reason for our success was our armamentarium of implants and instruments carefully packed in the five color-coded boxes and organized according to their use and indications." MEM

A very important reason for our success was our armamentarium of implants and instruments carefully packed in the five color-coded boxes and organized according to their use and indications. These were available and used in each AO clinic. At that time surgical instrumentation, particularly for trauma, was still in chaos. The AO had not only new principles but now the necessary implants and instruments that facilitated the clinical realization of our message.

"It was not possible to spread the AO message just through the AO courses and lectures. We had to publish. Our first book appeared in 1963 in German and was translated into English as Technique of Internal Fixation of Fractures, published in 1965." MEM

It was not possible to spread the AO message just through the AO courses and lectures. We had to publish. Our first book appeared in 1963 in German[1] and was translated into English as *Technique of Internal Fixation of Fractures*, published in 1965. Because it provided little information on the actual technique of internal fixation, we decided to undertake a more comprehensive work that would explain each operative step in detail. This was the first AO manual published in German in 1969.[2] Joseph Schatzker's English translation published in 1970[3] was a very important contribution because it explained the technical details of our method to the whole world. The second edition in German was published in 1977; in 1979, it appeared in English, translated again by Schatzker. If you consider that the second edition, even at its high price, sold over 100,000 copies, you can begin to appreciate our amazing global success.

1 Müller MEM, Allgöwer M. *Technik der operativen Frakturenbehandlung*. Heidelberg: Springer; 1963. German.

2 Müller ME, Bandi W, Willenegger H, Allgöwer M. *Manual der Osteosynthese: AO-Technik*. Heidelberg: Springer; 1969. German.

3 Müller ME, Allgöwer M, Willenegger H. *Manual of Internal Fixation: Technique Recommended by the AO-Group Swiss Association for the Study of Internal Fixation: ASIF*. Heidelberg: Springer; 1970.

JS: Maurice, please explain the contribution of each of the members of the early AO.

MEM: The AO was most fortunate in its founders and early surgical members. One of the most important was Hans Willenegger, the most senior trauma surgeon in our group. In the early 1960s surgical research was almost unknown, but Willenegger had done research and understood its importance for the AO. He was also fortunate in having as his chief resident Johannes Müller, a very promising surgeon, who became the chief of trauma surgery in Liestal in 1975. Sadly, he died in 1983 at the early age of fifty. As a young man, Müller had worked out the histological details of how a pseudarthrosis heals when placed under compression. Robert Schenk is generally credited with this work, but that is wrong. Schenk had worked with Harold Frost[1] in the United States where he learned the importance of studying events in bone from non-decalcified sections, but it took a long time before he was able to sequence the events of healing of a pseudarthrosis. The histology of sequential healing of a pseudarthrosis under compression and absolute stability was important for me in the early days of AO, for it allowed me to show that the AO had demonstrated something original that had not been previously seen. Because I found it difficult to understand why it took Schenk so many years to work out all the intricacies of the process, there was friction between us.

Willenegger was also important because he took on the role of the AO missionary. He was admired by a wide circle of friends abroad for his teaching, for his scrupulous honesty, and for his devotion to hard work. Willenegger was also the first to stress documentation. His system was totally different from mine, but he understood the importance of documentation as evidence for our concepts.

Not all our colleagues were Swiss. Andrew Bassett, who worked with Stinchfield in New York, was a valuable associate in America. His work with millipore experiments was valuable. We also learned much from Heinz Wagner in Germany, who was the first to show how bone reacts when exposed to sustained compression. Wagner demonstrated bone hypertrophy on the side of increased pressure, and resorption on the opposite side. His work demonstrated histologically that a lag screw can apply compression, that bone does not resorb under compression, and that bone will atrophy if not under load. To achieve this, Wagner crossed the epiphyseal plate with the lag screw; it was the continued growth of the epiphyseal plate that maintained compression. We used Wagner's findings to explain why compression between fragments could be maintained and why it did not result in resorption. The actual proof came years later through Stephan Perren's[2] work with strain-gauges and intra-vital injections of plated bones. Böhler, who studied classic bone healing, maintained that there was obligatory resorption of bone ends and that shortening of the fragments had to take place before

1 Harold M Frost (1901–2004) was an orthopedic surgeon who was one of the most important researchers and theorists in the field of bone biology. He became an assistant professor of orthopedic surgery at the Yale School of Medicine in 1955. From 1966 to 1972, he founded and directed the Orthopedic Research Laboratory at the Henry Ford Hospital in Detroit.

2 Stephan M Perren (b. 1932) was the Director of the AO Research Institute Davos from 1967 to 1995. In 1984, he became one of the founding members of the AO Foundation. Dr Perren also chaired the AO Technical Commission and the AO Development Steering Committee for sixteen years. In 1980, he became professor extraordinarius for experimental surgery at the University of Basel and in 1982, extraordinarius for surgical research in the Faculty of Medicine at the University of Bern.

healing could occur. This concept of obligatory resorption was used by many as an argument against our concept of bone healing under compression and our concept of primary bone union and absolute stability.

The early concepts of primary and secondary bone healing were developed by general surgeons like Willenegger and Allgöwer, who had little understanding of bone. As general surgeons, they transposed the idea of soft-tissue healing to bone. They made a comparison with skin, which heals differently if there is a gap than when the edges are in contact. Extrapolating from skin, they considered that the healing of a gap in bone was the problem. When Perren explained the events of bone healing under absolute stability, we had to revise our initial concepts of primary and secondary bone healing. Today we recognize bone healing and remodeling as two completely different events. When bone fragments are under absolute stability, the bone ends are not resorbed despite being dead. Instead, the dead bone is fully remodeled. It is this remodeling process, consisting of new Haversian canals which cross over from one dead bone fragment to the other that restores bone continuity. If there is a gap, the gap heals first by the formation of woven bone before remodeling takes place. Under absolute stability, union is the result of the process of remodeling and not what we normally call bone healing. The classic concept that bone heals by the formation of callus is valid.

Martin Allgöwer was a man of great talent. His ability to speak English well and his ability to diffuse difficult social and political situations was important. He had the gift of humor and of word play, even in English. In the early days of the AO, Martin was unquestionably the most respected and well-liked, young general surgeon in Switzerland. He was also extremely talented technically, and although bone was not his preferred tissue and organ, he rapidly adopted all the principles and methods of osteosynthesis in his clinic in Chur, which became a showplace of excellence.

Without Robert Schneider, the AO might never have been established. He was the most serious member of our group and was always full of good ideas. He always reminded us that the one case which turns out badly is always the most important because it will teach us what to avoid. He introduced me to Willenegger, who then introduced me to Allgöwer. Schneider was elected *Obmann* (leader) of the Swiss AO in 1958 and occupied that position for the first twenty years of our existence.

"Without Robert Schneider, the AO might never have been established. He was the most serious member of our group and was always full of good ideas. He always reminded us that the one case which turns out badly is always the most important because it will teach us what to avoid." MEM

JS: Maurice, in the first ten years between 1960 and 1970, who provided direction for the development of the AO? Did the group discuss these issues?

MEM: I was the one who made the decisions, but I could always depend on Schneider to push ideas forward. I would discuss things with Schneider first, and once we agreed, he would take over and persuade the others.

JS: How were decisions on personnel made, such as who would be hired to run the laboratory for experimental surgery?

MEM: Well, the first man was the laboratory technician, Ernst Frey, who worked with Martin Allgöwer. Then I brought a scientist from Bern, Dr Herbert Fleisch, to take this position. It was Martin Allgöwer who suggested that we hire Stefan Perren. At first, he did not seem very promising, however his work with strain-gauges was valuable and he was of enormous help in our continuing research. Stefan Perren provided invaluable leadership in research and exemplary service as a lecturer and teacher. He understood biology, mechanics, computers, and most of all, he knew how to build a research team and attract bright minds.

JS: Who was the one to make contracts with your producer? Who was the voice and the brain?

MEM: I had the best head and vision for business affairs—certainly not Martin. The other members of the early AO group did not play deciding roles in business matters. First, I would discuss these issues thoroughly with Peter von Rechenberg, the chairman of Synthes AG Chur. At the beginning, we rarely had what you would call a regular meeting. We would simply phone one another and talk about things. Later, we would meet twice a year, at the AO courses and at the annual meeting of Swiss AO, which we also combined with our annual ski races. We also took some special trips, like our visits to Canada to do heli-skiing. We funded these privately or from the sale of the books. We would get a lot of business done on these occasions. Because we were a small group, power struggles were not an issue. Things became more complicated as the younger generations slowly came to the fore and began to express their opinions. When Schneider retired in 1978, after twenty years, and then two years later Bandi retired, I found myself isolated and in a progressively weaker and weaker position.

The first formal contract with industry

MEM: My contract with Mathys in April 1958 was verbal. It remained in force until the first AO course when we signed the first official agreement between Mathys and Synthes AG Chur. In 1960, when we started to have a problem with corrosion of the stainless steel we were using, we had no idea what to do. Willenegger suggested that we contact the Straumann Institute, a laboratory in Basel, which dealt with metallurgical problems. We invited Fritz Straumann to an AO course for a consultation. This gave us an opportunity to show him what we were doing.

There were other problems beside the choice of metal for implants. When we began, we would have been lost without Mathys. However, he made only what I told him to make and had great difficulty understanding how to increase his business operation. Also, because of the AO's success Mathys could not keep up with the orders. Unlike Straumann, he did not have the necessary infrastructure. He needed more modern machinery and more staff. He realized that it would take a year before his new employees would know what to do. That's why he almost went bankrupt.

The Straumann Institute was not only a laboratory but it also made parts for watches. When we asked Straumann whether his company would be interested in making plates and screws, he was eager to collaborate with us. Once Mathys and Straumann began to talk together, they realized that they needed to cooperate, since they would be making the same things. First, they had to agree on the price they were going to charge.

[That was surely the beginning of price fixing.]

By 1963, the business had grown to the point that they were flooded with orders from all over the world. They realized that it made no sense to be competing with one another in the same area. One day, as they sat in the restaurant of a railway station, they agreed to divide the world. Because Mathys, who had his own airplane, frequently flew to Asia and Africa, he retained these two areas. He had no interest in North America; it went to Straumann. They both delivered their products to Germany and somehow agreed on how to divide Germany. Peter von Rechenberg told them that they had a week in which to come to an agreement. It was simple. They sat down and soon had an agreement.

All things finally had to come to Synthes AG Chur. Von Rechenberg first drew up the agreement. In 1963, we signed the first formal agreement among Synthes AG Chur, Straumann, and Mathys.

"In 1971, we decided to create AO International (AOI). It would ensure that courses in other countries followed the AO philosophy and that teaching courses did not use implants other than those of AO, that is those of Synthes AG Chur and our two producers." MEM

The beginning of AO International

MEM: AO activity was increasing in many countries and the international faculty for the many courses was growing. We realized that we needed an organization to control our educational efforts. In 1971, we decided to create AO International (AOI). It would ensure that courses in other countries followed the AO philosophy and that teaching courses did not use implants other than those of AO, that is those of Synthes AG Chur and our two producers. This was the price of exclusivity for the two producers. They were not allowed to sell anything else, and at the same time, we assured them that surgeons who wanted to belong to our surgical community had to use AO implants and instruments when teaching. Use of the same implants and instruments was the very basis of cooperation within the AO. Product policy had to remain within the Technical Commission (TK) and Synthes AG Chur. To maintain control and standardization, the TK had to have power over design and production. By making surgeons members of AOI, they would commit themselves to follow AO philosophy and practice. This meant that they could not make their own implants and instruments and would use, by preference, only Synthes products. AOI was responsible for providing standardized teaching material, such as slides, videos, etc, and also for coordinating teaching and growth. We could not run a course without the assurance of the producers' support, since they were responsible for the physical infrastructure. At the same time, the producers could not run courses without our faculty support. Our faculty provided the teaching, and the producers, who worked closely with AOI, provided the logistic and material infrastructure for teaching, including the AO sets and audiovisual requirements.

In 1973, Hans Willenegger decided to leave his job in Liestal and gradually take over the presidency of AOI full-time. Martin asked how much he should be paid. I suggested a sum to start with and let us know, after a while, if it was adequate. All he had to do was to say how much he needed and it would be his. Some decisions were made as issues became clearer and clearer.

Business and financial matters

MEM: On my second visit to North America in the early summer of 1960, I participated in the SICOT (International Society of Orthopaedics and Traumatology) meeting at the Hotel Astor in New York. I gave two important presentations at this meeting. To display my poster presentation, I had hired a booth. Dr Andrew Bassett, a coworker of Professor Stinchfield, was very kind to help me set up my booth. Immediately next to my booth was a company called Howmedica, which dealt in surgical implants. I had no idea what this company was, but its representatives were pleasant. One day, they invited me to attend a musical. Our wives came along, and we had a lovely evening. On the way back, when we began to talk about my presentations and about what I was doing, they were most interested to hear that I had designed a set of new bone plates and instruments. They were interested in showing them to their group of surgeons and possibly sell them in North America. After some preliminary discussions, we agreed that I would give them one set of our instruments and implants. I had brought with me almost everything that we were going to use at the first AO course in December 1960. Howmedica and I agreed that they could make six copies. They would distribute these to the hospitals with which they had agreements, and these hospitals would test the equipment. We agreed to meet again in a year or two, after they had time to assess the results of the tests and see if we could come to an understanding. Howmedica made one important commitment: that if, for some reason, we could not agree to work together, they would destroy all the copies and not attempt to duplicate anything for their own use. As I think back to this, I realize I was more than naïve. I had nothing in writing, only their good word.

In 1962, two and a half years later, I came back to the United States. Dr Sandick's uncle, was suing the man who had hit him. I had been brought to New York with all my costs covered to act as an expert witness. When the lawyers of the other party found out that I had come to testify, they settled the case out of court the night before the trial.

Now that I was in the United States, I contacted Howmedica to see if they had come to any decision. The copies they had made were perfect, however, when I met with the company's head, he explained that even though the equipment had been used successfully, they feared that surgeons who used the equipment to treat fresh fractures would be subject to malpractice suits. With great regret, they declined the offer to work together. As promised they destroyed the copies they had made. They were very honest. I never had any further contact with them. In retrospect, they certainly missed an opportunity of a lifetime, as well as a great fortune.

Our next contact with North America came through Martin Allgöwer, who was working with Fritz Straumann, whose commercial territory included North America. Since I was very busy at my clinic in St Gallen and with working part-time in Bern, as well as with my work for the AO, I had little time and I was only too happy to leave the AO North American enterprise in Martin's hands. We trusted one another implicitly. I had no reason to think that the day would come that I would very much regret this decision.

Allgöwer and Straumann established contact in North America with Smith, Kline & French, a company that sold surgical implants and equipment. It became the North American distributer of the AO armamentarium. I remember one employee at Smith, Kline & French, Jim Gerry, who boosted sales when he organized a charter flight full of North American orthopedic surgeons to our AO course in Davos in December 1969 and again in 1970. Yet, despite considerable effort to make our surgical philosophy known in North America, progress was slow. We attributed this, in part, to the cost of our instrumentation. To ease the financial burden and facilitate sales, Smith, Kline & French, together with Straumann and Martin decided to make a smaller box of our plates and instruments just for the North American market. They called it a "beginner's set." Our original set was designed to contain everything necessary to treat any fracture. The smaller cassettes that they were now selling contained only some of the equipment. I said it was a mistake not to maintain the integrity of the entire system with its five boxes. Despite the cost reduction, the market in North America still moved very slowly and Smith, Kline & French continued to have difficulties. In the early 1970s, it was becoming obvious that something had to change. To inject some life into the North American enterprise, we decided to establish our own company, Synthes Ltd, to take over North American distribution. We had dig into our pockets and put up our own capital to establish the company.

"To inject some life into the North American enterprise, we decided to establish our own company, Synthes Ltd, to take over North American distribution. We had dig into our pockets and put up our own capital to establish the company." MEM

Synthes Ltd

MEM: Almost immediately, our new company Synthes Ltd ran into great financial difficulties because unlike Smith, Kline & French we had no distribution network in North America. As our sales dropped drastically, we suffered major financial losses. Our Synthes venture was under the direction of Scott Kerr, who had been successful in running Protek Canada. Sales of my hip implants, which were distributed in North America by DePuy, were doing very well, but my hip business had nothing to do with the Synthes business.

It soon became apparent that we were over our heads with Synthes Ltd. Scott Kerr was pressing for more money, despite our financial losses. He wanted the company to buy cars for the sales force. We couldn't understand this. We thought that the sales people should use streetcars and trains. I remember complaining about this unreasonable demand to Joe Schatzker, who tried to explain that North America was an enormous continent and that a car was a necessity for salesmen.

As we were losing money, Martin Allgöwer, who was responsible for North America, came to me in 1974 with a request for financial support. I had money and with the support of Protek AG, my hip company, I provided two million dollars. I did not request any guarantee. Events later proved this to be a major blunder. I was very naïve. I thought I was dealing with friends with whom

formalities, such as guarantees, were not necessary. I had a very good business head and knew how to make money, but all my life money had little meaning for me. I never paid that much attention to whether I had money or not, and I was always generous with financial support. If the American enterprise needed money and if I had the money, I gave. In retrospect, I should have been less careless.

"I had a very good business head and knew how to make money, but all my life money had little meaning for me. I never paid that much attention to whether I had money or not, and I was always generous with financial support."
MEM

At about the same time, Martin Allgöwer bought himself an airplane in North America. He had become an avid pilot, but a flight over the Atlantic was more than he could handle. He needed a pilot to help him fly the plane to Europe. He had made the acquaintance of Hansjörg Wyss, a Swiss, who was a pilot, an engineer, and a businessman. I don't remember how and where they met. Mr Wyss and Martin flew the plane over the Atlantic. The journey was hazardous, and at more than one point they almost lost their lives. The experience bonded the two men. From that moment on, Martin Allgöwer, who had always come to me for counsel, came under the spell of Mr Wyss.

Since 1969, Mr Wyss had worked for a large company in Brussels. Because of some internal company issues, he was looking for another business opportunity. After that flight home, Martin suggested that his new friend Hansjörg Wyss should help us with our failing North American business venture.

Synthes Ltd USA

JS: Maurice, when did you first meet Hansjörg Wyss?

MEM: I first met him at an informal meeting in 1974. I must say that from our first meeting, I was not sure that I would get along with him or that I wanted to do business with him. As things played themselves out in the years to come, my nose was proven right.

JS: How did the new business venture fare now that you had Mr Wyss and his business talents on your side?

MEM: Initially, we had to invest some more cash, as the firm did not have sufficient capital. To fill orders quickly in North America the group decided, on the advice of Mr Wyss, to build a factory in Colorado to manufacture implants for the North American market. AO sales were booming everywhere and Straumann and Mathys, despite major efforts, were constantly behind in filling North America orders. The organizational changes suggested by Mr Wyss helped us turn things around.

The years in North America from 1975 onward were under Martin's guidance. I was extremely busy in Bern. A high academic appointment like that of primarius brought with it many organizational and academic problems. I had to concentrate all my efforts on Bern and on the running of the AO through Synthes AG Chur. I remember little of all that happened in North America during these years. I was neither involved in all the decisions that were taken, nor did I examine the business issues. By 1980, I had lost politically, and I had no longer any say in the North American AO enterprise. As a business investment, it had been a failure for me and represented a significant financial loss.

JS: Maurice, can you tell us a bit more about the problems in Europe?

MEM: As the AO's fame spread, I received many invitations to visit orthopedic centers. A few such trips took me to Alsace in France. On a visit to Strasbourg, France, I had the opportunity of seeing the work of Ivan Kempf[1] and Arsène Grosse[2]. These two innovative surgeons had modified an intramedullary nail by drilling holes in the proximal and distal portions, so that one could pass a bolt transversely through these holes. A complex multifragmentary fracture of the femur is a contraindication for nailing with an ordinary nail because of the inevitable shortening and backing-out of the nail. One does not have to bear weight for the shortening to take place; muscle contractions are enough. To deal with this problem, Kempf and Grosse used their modified nail. While the bone was reduced under traction, they locked the proximal and distal fragment to the nail by passing bolts through the fragments and the nail. One can compare this to a shish kebab. They showed me a collection of their cases. Treated with interlocking nails, these fractures, which were generally so difficult to treat with plating and always had to be bone grafted to secure union, united quickly with an explosion of callus formation. The advantage of the method was self-evident. It was a minimally invasive operation like any closed nailing, but now the nail and the bone were locked together. The downside of the procedure was that one required C-arm control to insert the distal locking. They had developed a special jig which guided the proximal bolt.

I immediately saw the great advantages of their technique and invited them to come to Davos to present their work to my colleagues. I had also had met Klemm[3] and Schellmann,[4] who were also working on the development of closed, locked intramedullary nailing. The idea of locking an intramedullary nail was in the air, and several investigators were working on different designs.

Ivan Kempf came to Davos in December 1978 to make his presentation. It stimulated a heated discussion in the Technical Commission as to whether to accept locked intramedullary nailing as a new AO principle. I was very much in favor of our adopting it. Stefan Perren, who oversaw our research institute and was not involved in surgery, remained neutral. However, Martin Allgöwer and his colleagues from Basel, Thomas Rüedi and Peter Matter, rejected the concept. They were joined by Sigi Weller[5] from Tübingen, Germany and Hardi Weber from St Gallen. Their decision delayed our progress. The AO lost its edge in intramedullary nailing and has not regained it to this day.

1 Ivan Kempf (b. 1928) worked at the Centre de Traumatologie et d'Orthopedie in Strasbourg, France.

2 Arsène Grosse (b. 1938) worked with Ivan Kempf at the Centre de Traumatologie et d'Orthopedie in Strasbourg, France.

3 Klaus Klemm (1932–2000), a surgeon at the Accident Clinic in Frankfurt, reported to the German Society for Accident Medicine in 1971 on his technical modification of the Küntscher nail.

4 Wulf-Dieter Schellmann (b. 1932) worked in the accident clinic of the County Hospital in Peine, near Hannover, Germany.

5 Siegfried Weller (b. 1929) became the medical director of the Accident Clinic in Tübingen in 1969 and professor in the medical faculty of the University of Tübingen in 1977. He served as president of the AO Foundation from 1994 to 1996.

When I lost the battle over the locked nail in the TK in 1978, I sensed that I was gradually beginning to lose influence over development of new implants and clinical methods of treatment. With the retirement of Schneider as Obmann of the Swiss AO and from Synthes AG Chur, I lost support for my initiatives and guidance of the TK, and over the AO financial arm Synthes AG Chur. In early 1980s, I had lost a major investment in North America and no longer had influence in North American affairs. To add to these events, I retired from my position as professor at the University of Bern. These were major turning points in my life.

"When I lost the battle over the locked nail in the TK in 1978, I sensed that I was gradually beginning to lose influence over development of new implants and clinical methods of treatment."
MEM

JS: Maurice, you retired from the University of Bern at age 62.

MEM: Yes, I retired in 1980. I could have stayed longer, but the difficulties that I encountered when I came to Bern continued. The university demanded many hours of my time for work on committees and as head of a large, clinical department, my administrative duties were heavy. I felt that I had come to the point in my life that I could make better use of my time.

The AO Foundation

JS: Maurice, the early 1980s were also the years that the AO Foundation was created. How did the AO Foundation come into existence?

MEM: Well, a foundation was not a new idea for the AO. We already had three foundations within the AO: one for documentation, one for the alumni of AO International, and AO International itself, founded in 1971.

JS: Who came up with the idea of reorganizing the entire AO organization into a foundation?

MEM: Who thought of it? Whose idea was it? I don't think it was Martin Allgöwer's alone, I have heard it said more than a few times that the concept of a foundation was so complex and far-reaching that Martin, who took ownership of the idea, could never have dreamt it up himself. Some say that it was, from the very start, Hansjörg Wyss' plan. I really do not know what to think, as I was not involved at the beginning.

JS: Why did you decide to give up control and guidance of the AO at such a crucial time? When so many of your close colleagues, who had positions of leadership in the AO, were retiring, the organization needed further guidance. Your retreat weakened it.

MEM: Well, I had led all the business affairs of the AO, that is, of Synthes AG Chur, from 1960 until 1982, a period of twenty-two years. I had wanted to give things up earlier in 1978, when my friend Robert Schneider retired as Obmann of the Swiss AO and from the board of Synthes AG Chur. He gave me his shares to hold, but I needed his vote to maintain control. Schneider had also given up his hospital appointment and moved to Biel, where he set up a private office and restricted his practice to total hip replacement. Then my friend Walter Bandi retired as well. Finally, I faced the most serious problem in 1974 when Martin Allgöwer, with whom I discussed all AO matters almost daily, stopped seeking out my guidance and began to turn more and more to Hansjörg Wyss for advice. After the early 1980s, Martin made all the plans and decisions for the AO.

Martin told me that we were most fortunate to have Mr Wyss because he felt that he had the imagination, acumen, and business skills to provide guidance and leadership for the AO. In my opinion, Mr Wyss was a very good businessman and a great organizer, but I never trusted him. I felt that no one paid less attention to people. He paid attention only to business. People were expendable. Just look at what happened to bright, surgical AO stars like Dr Dana Mears[1] and Dr Mike Chapman.[2] They were dismissed from the AO because they designed their own instruments and began to market them, in contravention of AO custom. It's true that in 1960, when I gave away my intellectual property, I provided a life-line for the AO to grow and prosper. This became a model which many AO members accepted as a rule of behavior. However, as the AO organization became financially and scientifically strong, it no longer needed strict adherence to this rule. It was far more important to retain brilliant and creative surgeons within the organization, so that they could continue their contribution to research and teaching. The rules we had were only a suggestion, but Hansjörg Wyss could not tolerate surgeons setting up commercial competition. Unfortunately, Martin Allgöwer and other surgeons could not find a solution to this dilemma.

You must also understand that the groundwork for the AO Foundation was being laid down as Martin Allgöwer was facing his own challenges. I retired from my position at the University of Bern in 1980 at the age of sixty-two. Martin, who was one year older than I, was due to retire from the University of Basel in 1982 when he would be sixty-five. He was desperately looking for a position of power. He finally stepped down from his job in Basel in 1983, the year Hans Willenegger retired from the presidency of AO International. Martin took over this position.

Then there were other issues. The biggest challenge Martin faced was his failure to have Thomas Rüedi, his protégé, appointed as his successor in Basel. Thomas had left Basel and gone to Chur, just as Martin had done to put himself in a stronger position to be the successor of Professor Nissen. Thomas Rüedi was not the only proposed candidate to succeed Martin; Dr Felix Harder was the other. As the outgoing chief, it was Martin's prerogative to indicate whom he preferred to be his successor. Martin was so confident that Thomas would be appointed that he let it be known that he had no preference. He thought this would strengthen Thomas' candidacy, but it may have been a political miscalculation. The opposite happened. Martin thought he could expect support from the chairman of the search committee, the orthopedic surgeon Dr Edwin Morscher. But Morscher, a paragon of ethical behavior, remained impartial. In the end, when it came to a vote, Felix Harder was chosen to succeed.

"It's true that in 1960, when I gave away my intellectual property, I provided a life-line for the AO to grow and prosper. This became a model which many AO members accepted as a rule of behavior." MEM

This was Martin's first great personal and political loss. The second was when Thomas Rüedi applied for the position of professor in Zürich when Dr Buff retired. Martin did whatever he could to get support for Thomas, but in vain. This was a great disappointment for Martin, for Thomas was a superb teacher and lecturer, a respected surgeon, and a known personality, who had excellent academic credentials.

1 Dana Mears practices in Pittsburgh, Pennsylvania.

2 Michael W Chapman (b. 1937) is professor of orthopedic surgery at the University of California, Davis. He was chairman of the department of orthopedic surgery from 1979 to 1999.

In 1982 after only four years as Obmann of the Swiss AO, Martin relinquished the position to Peter Matter and in 1983 took over as president of AO International. But Martin clearly had his eye on the AO Foundation.

JS: When did you first hear of the idea to create an AO Foundation?

MEM: Up to 1982 I had not heard mention of the idea of the creation of an AO Foundation from any source.

JS: But Maurice, I remember Thomas Rüedi and Martin Allgöwer discussing the idea of a foundation with me in 1980 or early in 1981 at one of the AO courses at the Broadmoor hotel in Colorado. Am I wrong about the date? They were also discussing this proposal with other senior colleagues with the understanding that it was not a public matter.

MEM: Some may have discussed it earlier, but it did not come to my ears until 1982. You say that it was discussed in the United States but I had virtually no contact with that arena, except, of course, through my hip business, but the two did not mix. It was in 1983 that the idea began to mature, and in early 1984 that statutes for the new AO Foundation (AOF) were drawn up. They were signed by the founding members in December 1984. I objected strongly to the notion that the three producers, Mathys, Stratec,[1] and Synthes USA would have seats on the board. In my view giving them a position on the board of the planned new Foundation was wrong. Martin Allgöwer argued that this meant that the foundation would not be abandoned by the producers, but I had never heard that the producers had any notion of disassociating themselves from the AO and the AO surgical community. It was their lifeline. Martin argued further that the producers would have only three seats and that since there would be five medical board members, the producers would always be in a minority. A part-time chairman would be appointed who would cast a deciding vote in case of a tie. Having had years of experience with boards, I knew that as soon as one of the medical members chose to vote with the producers, they would have a majority. I argued that the producers had money and power, which were strong persuasive forces with which to lure a medical member. I also argued that those who paid royalties to the AOF should not have a vote on the body which decided on the size of the royalty payment. I opposed the establishment of the foundation on these grounds until about ten days before the agreement was to be signed.

I fought the agreement to the very end, but they begged me not to let them proceed without me. They almost implored and kept saying, "How would it look. AO without you!" In the end, Martin Allgöwer pushed and pushed, and I finally gave in. I gave them all my shares in Synthes AG Chur, as well as the shares Schneider left me. In retrospect, I now see that my agreement to sign the papers was a serious mistake. I wondered what Martin thought he was achieving with the formation of the Foundation. He told me that he felt that without Hansjörg Wyss the AO would fall apart. Putting Mr Wyss on the board put Martin in a position of influence.

1 In 1990, Straumann sold its implant to Stratec Medical, a privately owned company.

I fully understood that changes were necessary and perhaps well overdue. For instance, our expectation to have people donate their intellectual property to the AO had become naïve. Synthes' competitors were rewarding creative surgeons with a great deal of money. The AO was out of step with the rest of the industry. I thought that a part of the royalty should go to surgeons and the AO organizations in their countries of origin. But the creation of the AOF, particularly the way its governance was being structured, was a mistake.

Maurice resigns from the Board of the AO Foundation

MEM: It soon became apparent to me and others what we were facing on the board of the new AO Foundation. Between 1984 and 1987, Hansjörg Wyss made my life on the AOVA (AO board of directors) difficult and unpleasant because we continually had differences of opinion. He peppered me with questions and provoked hostile discussions. Up to this point we had always looked at our organization as an organization of friends. We did not adhere to what one might call proper rigid business practice. We got along. The organization thrived, and all was well. The world was literally at our feet. Mr Wyss had a very different background. He was Mr Business.

I served on the board until the trustee meeting in 1987 in Baden Baden. It was then that Mr Wyss openly challenged the AO's activity in documentation. He questioned its value as a scientific exercise and the amount of money the AO was budgeting to support it. Even though he was one of the founding members of the Foundation, the interference of a producer in medical matters, especially an attack on one of the basic principles of the AO, was insupportable. Prospective documentation to maintain clinical quality control and as a means of evaluating new procedures and their safety was a central pillar of the AO. When the Swiss AO was established in 1958, it was agreed that a significant portion of the budget would be set aside for data collection. I had been president of documentation foundation from 1960. At the meeting in 1988, I resigned from the chair (**Fig 28**).

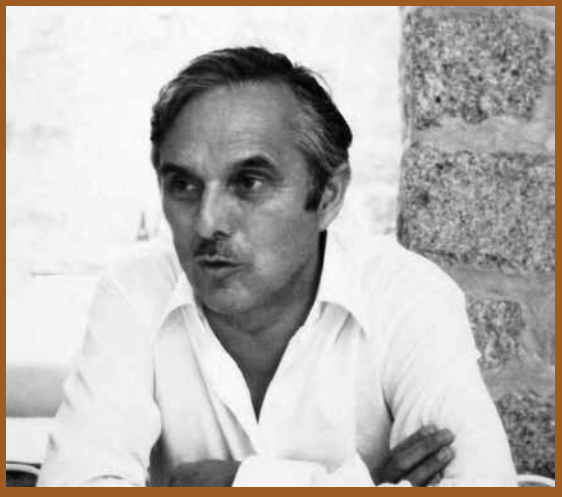


Fig 28 Maurice in his prime.

[It is easy to understand why Maurice became so upset when documentation was challenged. In his view, documentation was essential for the Technical Commission, which was responsible for the development and safety of new implants, as well as for providing the necessary evidence for the effectiveness of new procedures and new principles that the AO was developing. However, Hansjörg Wyss recognized that although documentation had been essential to prove the validity of AO principles and methods in the early years before they were generally accepted, it was always cumbersome and very expensive to maintain. Because documentation was so time-consuming, in most centers many cases were incompletely documented.

Maurice had extreme difficulty accepting that something that he had created and considered so important was being challenged and changed. This made it difficult for him to see the value of new developments. He was unable to accept new principles of treatment like relative stability, the bridge plate, and the development of minimally invasive surgery, which required x-ray control. Maurice maintained all along that x-ray control was unnecessary if you knew what you were doing. He could not conceive that someone could improve on what he had designed. He prided himself on being able to improve on what others were doing, but when it came to what he designed, things were different.]

With my resignation, Peter Matter was elected to take over the documentation foundation. Things went rapidly downhill, as I had feared. Dr Matter changed everything. First, he challenged the key principle that documentation be done in one center for all clinics. He decentralized the collection of data, leaving it to individual hospitals. For a short time, some maintained standards, but not for long. He also believed that cases should be documented for one year, or at the most, three years. Peter's approach revealed the philosophical difference in the treatment of trauma between general surgeons and orthopedic surgeons. For general surgeons, who dealt mainly with soft tissues, a complication at one year was no longer tied to the original operation, but indicated another problem. Orthopedic surgeons needed a much longer period of observation to assess if a procedure, such as an osteotomy or a total joint replacement, needed revision.

I did not do anything that would indicate to the public that I was removing myself from the AO, but I knew there was nothing left for me to do. The insiders knew that I was drifting away. I turned to other things where I could still make a difference, such as total hip replacement and orthopedics, where I had as much influence as I had in trauma. Accordingly, I wrote my letter of resignation from the board of the AO Foundation in January 1989.

"I did not do anything that would indicate to the public that I was removing myself from the AO, but I knew there was nothing left for me to do." MEM

The sale of Protek AG

MEM: The 1980s were a stressful period of my life. There were business issues to be resolved. Protek AG required a new direction. Up to this point, it had been a family-run business, but my son had no interest in the future of the company. Rolf Soiron, my brother-in-law, was the director of Protek AG from 1983 to 1987. He believed that the company should enlarge its activity from the production of "M.E. Müller originals," and carry other implants. Now, for the first time since the firm was formed, he wanted to take out a bank loan to finance expansion, and even proposed that it should "go public." I very much wanted Protek AG to continue as a family business and not become a public company, and forced to answer to shareholders. Thus in 1989, I decided to sell the business to the Sulzer firm. It became a subsidiary of Sulzer Medica, which in 1996 became incorporated into Sulzer Orthopaedics. I deposited the income from the sale in a special account which we set up within the M.E. Müller Foundation.

JS: Why did you give the money to your foundation?

MEM: I did not give it to my foundation. I deposited the money in a special account in my foundation. Royalties from the sale of my implants were used to support scientific endeavors. They were deposited in the Protek Foundation, which had been set up for that purpose. This foundation later became the M.E. Müller Foundation of Switzerland. I felt that the money from the sale of my company Protek AG had to be used in a more socially meaningful way. Protek AG grew from my initial personal investment in it, but it was Switzerland, its people, and the people who had received its products, who made it possible for the company to thrive and prosper. Now that I was winding up my company, the profits from the sale had to be returned to the people.

JS: Maurice, how did you continue your work in total hip replacement once you moved to Bern?

MEM: As I have said, I implanted the first total hip on the European continent in 1961. Charnley and I were the recognized authorities in this field. My total hip designs and instruments had a major share of the market. In 1975, when we opened Murtenstrasse 35 in Bern, I moved my hip documentation center along with the AO fracture documentation into a space on the same floor as my office. I also directed research in biology and biomechanics to support my hip initiatives and moved these to occupy the other three floors.

Once Murtenstasse 35 was completed in 1975, I began to organize the famous Bernese hip courses. We had an unparalleled facility and the lecture room was the most modern in Europe. We could organize simultaneous transmissions from the operating room of the Insel Hospital next door. I had started my total hip documentation project long before hip registries came into existence and could reach into my data collection and provide an audience with careful, prospectively documented follow-up of cases twenty to thirty years old. In the 1980s we modernized and computerized documentation and pioneered IDES, the international documentation and evaluation system.

SICOT

JS: Maurice, you were a long-time member of SICOT and a great supporter of this organization and its efforts. What role did it continue to play in your life?

MEM: I strongly believed in SICOT as an important international initiative for the dissemination of new ideas and discoveries. It was also a valuable forum for me to present my new ideas to the world beyond Switzerland and Europe. In 1973, I organized a symposium on articular fractures for the SICOT meeting in Kyoto, Japan. I invited Joseph Schatzker and Graham Allan Apley, a magnetic lecturer and well-known teacher from Britain, who was an exponent of nonoperative treatment of fractures, to speak at this symposium. Despite Apley's talent as an eloquent and persuasive speaker, he did not win over the audience, which was stunned by the remarkable demonstration of the results of complex articular fractures treated with the AO method which Joseph Schatzker and I presented.

"Protek AG grew from my initial personal investment in it, but it was Switzerland, its people, and the people who had received its products, who made it possible for the company to thrive and prosper. Now that I was winding up my company, the profits from the sale had to be returned to the people."
MEM

In 1975, I was elected to be the Swiss delegate to the SICOT meeting in Copenhagen. I had been a member of the American Hip Society since 1971, and at this meeting, I and my fellow members John Charnley and Frank Stinchfield founded the International Hip Society (**Fig 29a–b**). I also helped launch the SICOT journal through my connection with Springer Verlag[1] because I knew the owner Heinz Götze and his associate Mrs Kalow, who was responsible for medical publishing. All I needed to do was to provide financial support, which came from the Müller Foundation of Switzerland. Then toward the end of the meeting came word from Bern of a great emergency. I rushed home to treat the famous pianist Maurizio Pollini, who had fractured his neck and was at risk of becoming a quadriplegic. Pollini gave a concert in 1998 at the celebration of my eightieth birthday. It was a lovely way of saying thank you.

Maurice and postgraduate education

JS: Maurice, one of your great contributions has been your support for postgraduate education?

MEM: When I lectured to surgeons in Winterthur in 1951, I learned an important lesson: that to have success as a teacher you must have academic credibility. My first step was to get the degree of privatdozent (PD). I began when I was chief resident by concentrating on hip surgery as an area in which I hoped to excel. I introduced new procedures, but I made certain that the cases were meticulously documented. My thesis on the osteotomies of the proximal femur, which I submitted for my PD, brought me academic credibility, not only when I presented it to an audience in Zürich but also when it was published. The book, *The Osteotomies of the Proximal Femur*, which won a prize from the German Orthopaedic Association, describes my activities as chief resident at Balgrist.

1 Springer Verlag is a German publisher, specializing in scientific, technical, and medical books.

Fig 29a–b
a The International Hip Society, 1976. Note the founding members: Frank Stinchfield, John Charnley and Maurice.
b Meeting of the International Hip Society at Murtenstrasse 35, in Bern in the spring of 1987.

I also felt it was essential for a surgeon to be technically excellent. I perfected my surgical technique while working in Ethiopia and was admired for my technical brilliance. It was said that the tissues parted for me by themselves. I also believed that documentation and our outcome studies cemented my ability to convince the world of my academic achievement. All these principles were the basis of my postgraduate teaching. I always said that learning leads to teaching and teaching leads to further learning and greater understanding. The symbol that I used to illustrate my theory of postgraduate teaching was the image of three intertwined rings: one for learning, one for teaching, and one for evaluation (**Fig 30**).

Once I had my own surgical clinic, first in St Gallen and then in Bern, I was able to continue postgraduate education in the operating room. I used visual media to allow more people to observe procedures. When the Swiss Trauma Society met in St Gallen in 1964, I designed a system which consisted of a large screen on which images were projected directly from the operating room. This system became the model for the design of the lecture room at Murtenstrasse 35 in 1975; it took advantage of the most modern techniques of image transmission and communication. Each participant could not only see images from the operating room in real time and high definition but could also come into direct contact with the operating surgeon. All that the moderator had to do was to touch a switch.

Fig 30 Maurice used this symbol to show his theory of postgraduate teaching.

I have always said that the best way to learn is to teach. Attempting to explain a concept to someone else often improves your own comprehension of the subject. If you can explain a new concept to someone, you will have grasped its essence. I also had the gift of knowing what people would want to hear and learn even before they knew it themselves. When I was teaching postgraduate surgeons, I always encouraged them to make presentations. In this way, I could judge who would be a good teacher, who had promise.

Teaching was also a principle in my design of instruments. Each had a specific purpose that followed a logical principle. They had to work not only in my hands but also in the hands of others. Using the instruments effectively was an important aspect of teaching. Surgeons could not learn the new techniques the AO developed only from lectures or articles. Surgical dexterity was imperative and for that, the practical courses allowed instruction in surgical techniques through work on simulated fractures in bone models with the proper instrumentation and implants. In our AO courses, we also trained the surgeons progressively, from teaching as a table instructor, to lecturing, to becoming a faculty member.

I also taught the principle of careful preoperative planning and decision making. It was imperative that decisions be based on outcome and evidence. First, you had to define a fracture. This would allow you to classify it. Once it was classified, you could support your decision-making on knowledge from available literature. Through careful follow-up and outcome studies, you could then judge the results of your own treatment. From this, an individual surgeon and his hospital could assess the results achieved by its surgical staff by comparison with those in other institutions. This progression from definition, to diagnosis, to classification, to treatment, to analysis of results completes the circle of learning and teaches us the importance of evidence-based decision making.

"This progression from definition, to diagnosis, to classification, to treatment, to analysis of results completes the circle of learning and teaches us the importance of evidence-based decision making."
MEM

Classification of fractures

JS: I remember visiting you on a sunny summer day in 1980 at Murtenstrasse 35 and finding you surrounded by stacks of boxes of old punch cards of documented fracture cases that you had so carefully collected for many years.

MEM: Now that I was retired from teaching and administrative duties, I had time to concentrate on a project that had always been important for me: a comprehensive classification system of all fractures. I never really abandoned this activity. I recognized the need for a system in the mid-1960s, and attempted to classify fractures of the distal femur into types A, B, and C. During my tenure as professor, I required all assistants and chief residents to collect fractures of various segments of long bones. They were then given the task of discovering their essence that would allow them to organize the fractures in an ascending order of severity—A, B, and C. For instance, I assigned fractures of the proximal segment of the humerus to my resident Roland Jakob.[1] He made important observations which helped with the classification of these difficult fractures.

"The number three has always had a fascination for me. In my system, each long bone has three segments and each segment has three fracture types, labeled A, B, and C. Each fracture type, in turn, was divided into three groups and each group into three subgroups. The grouping of triads was the basis of my organization." MEM

JS: In your classification exercises, it seemed that you were fascinated with the number three.

MEM: Well, yes. The number three has always had a fascination for me. In my system, each long bone has three segments and each segment has three fracture types, labeled A, B, and C. Each fracture type, in turn, was divided into three groups and each group into three subgroups. The grouping of triads was the basis of my organization. This was not an easy task. It took seven years to write *Classification AO des fractures*[2], which I published with Serge Nazarian[3] in 1987. This volume, however, did not mean that the task of classification was finished. There were still many outstanding problems to settle. I worked closely with my SICOT committee on documentation and classification and with Joe Schatzker who made major contributions to the completion of this work. First, he translated the French book into English and then edited and helped us integrate the new concepts, which we formulated between the publication of the French book and the much more complete and important English version. Joe Schatzker became one of the authors.[4]

JS: Maurice, do you remember when we were at the trustee meeting in Baden Baden in 1987. I was a member of the SICOT Presidential Ad Hoc Commission on Documentation and Evaluation. You and I were struggling with the term "comminuted."

MEM: I was convinced that any classification system that depended on a graphic portrayal of a fracture was doomed. The laws of nature determine how bones break. Each fracture has its essence, which makes it a specific fracture, but this

1 Roland P Jakob was chief surgeon of the orthopedic clinic of the Fribourg Hospital from 1995 to 2007.

2 Müller ME, Nazarian S. *Classification AO des fractures*. Paris: Springer; 1987. French.

3 Serge Nazarian, an orthopedic surgeon, was chief of traumatology and spine surgery at the Hospital of the Conception in Marseilles.

4 Müller ME, Koch P, Nazarian S, Schatzker J. *The Comprehensive Classification of Fractures of Long Bones*. Berlin: Springer; 1990.

does not necessarily mean that fractures of the same type always look alike. That is why I have always maintained we must not base a diagnosis on its appearance but on its essence. The term *comminuted* means that the fracture has more than two pieces. Beyond this, the term is meaningless. It was necessary to find a concept and expression that would define the essence of a fracture without resorting to an image. Once that was possible, you could phone a colleague and tell him exactly what you saw on an x-ray without the colleague's having to look at the x-ray. Counting the number of bone pieces was not productive. Finally, after a long time and many meetings, we came up with the concept that a fracture was either a simple type A fracture, that is having two main fragments, or it was multifragmentary. The term multifragmentary had to be defined further so that it made sense. We divided the multifragmentary fractures into type B and type C. Type B were those fractures in which, after reduction, there was contact between the main fragments. These are the wedge fractures, in which the wedge could be one piece or more. The shape of the wedge could be spiral, or it could be a triangularly shaped extrusion fragment. The essence of the fracture was the contact between the main fragments after reduction and not the number of pieces of bone. The contact gave length-rotation, axial alignment, and greatly facilitated reduction. Type C includes those in which, after reduction, there is no contact between the main fragments. These were more difficult to treat because length-rotation and alignment were harder to determine. The complex fractures were divided further depending on their mechanism and pattern: spiral, segmental, or irregular. Now we had a means of communication. To define the meaning of terms, we published a glossary. To facilitate classification, we developed a system of binary questions which, when correctly answered, would lead to the essence of the fracture.

The culmination of this effort was the publication of *The Comprehensive Classification of Fractures of Long Bones* in 1990. Because modern databases are computerized, we designed an alphanumeric system of coding the various fractures with a system of numbers combined with letters. This was done to facilitate digital entry and retrieval. Each long bone of the skeleton was given a number. The three segments of each bone—proximal, middle, and distal—were denoted by numbers one, two and three. Thus, the proximal segment of the humerus would be written as 1.1. The diaphysis of the humerus would be 1.2. The types of the fracture are denoted by the letters A, B, and C. Thus, a simple fracture of the proximal segment would be 1.1A. This system was designed for computer entry and not for verbal communication. Surgeons who find it a clumsy means of verbal communication should remember that it was never meant to be used in this way.

The comprehensive classification of fractures of long bones was first adopted by the AO Foundation as its system of classification. The Orthopaedic Trauma Association (OTA) adopted it a little later, calling it the AO/OTA of North America classification. As a comprehensive classification system, it proved to have a high index of intrapersonal and interpersonal reliability. It has since been chosen by almost all major journals as the classification system to use when specifying a traumatic bone injury. All the fracture types, groups, and subgroups were validated as actually existing in a monumental work on this subject by Professor R Orozco and colleagues, *Atlas of Internal Fixation of Fractures of Long Bones*.[1]

"The comprehensive classification of fractures of long bones was first adopted by the AO Foundation as its system of classification.... It has since been chosen by almost all major journals as the classification system to use when specifying a traumatic bone injury." MEM

1 Orozco R, Sales JM, Videla M. *Atlas of Internal Fixation of Fractures of Long Bones.* Berlin: Springer; 2000.