

Joseph Schatzker

# Maurice Edmond Müller—In His Own Words



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## Foreword



**Joseph Schatzker**

In 1965, Maurice Müller was invited as a guest speaker to a Rehabilitation Symposium, an orthopedic meeting held annually in Toronto, Canada. His new, controversial theories and methods were just becoming known in North America. Since no one in Toronto knew if Professor Müller spoke English, Dr Edward Simmons, who was organizing the meeting, appointed me, a resident in the orthopedic program at the time, to be his guide and interpreter because I could speak German. The week that I spent translating Professor Müller's lectures and listening to his ideas opened my eyes to a radically different, promising world of orthopedics. I decided that I must study with him. When I was awarded a fellowship to study abroad, I told the professor of orthopedics in Toronto of my decision. Professor Dewar was open to new ideas, but he was doubtful about Müller's theories. "I have lived through two periods of surgical innovations and miracles which ended in total failures," he said. "Go and get it out of your system."

I had the good fortune of working with Professor Müller in Switzerland in 1967, at the time that he and his colleagues were writing the first edition of their manual for the AO (Arbeitsgemeinschaft für Osteosynthesefragen [Association for the Study of Osteosynthesis]). The professor ordered that I translate the book from German into English, and through this project, which involved close contact with him every day, I was able to immerse myself in the AO philosophy and learn its techniques. I failed "to get the AO out of my system." My translation of the first edition of the AO Manual was published in 1970; other joint publications followed. I spent much of my career in close collaboration with Maurice on many projects until 2005, our last personal contact.

I knew that the success of the AO method of internal fixation of fractures was due mainly to Maurice Müller's genius: his unceasing quest for the best way to treat problems of the musculoskeletal system, his ability to recognize promising ideas and techniques and improve them, his gift for inventing and designing surgical instruments, and his understanding that new surgical methods must be supported by research, impeccable documentation, and teaching of practical skills. The story of how Maurice transformed fracture treatment and pioneered surgery for hip disease is remarkable. It is a story of a surgical entrepreneur whose genius and discovery set off a surgical revolution which swept the world and made it a better and healthier place. I felt it needed to be told.

*“Müller was the prime mover in the operative treatment of fractures, the man who articulated the principles of osteosynthesis and whose vision resulted in the steps which led to the organization of the AO.”*

Accordingly, between 2000 and 2004 I conducted a series of interviews with Maurice about his life and work: the first in Davos in December 2000 and the last in Bern in June 2004. Our sessions lasted from 1 to 3 full days and resulted in more than 150 hours on tape. Maurice appreciated the historical significance of the project and never tired. At the end of each interview session, we would discuss and agree on the topic for the next. This allowed him to review his records and refresh his memory. With his discipline for documentation, Maurice had records of most events and would invariably call upon Miss Eleonore Moosberger, his personal secretary of many years, to fetch this or that.

This book is an edited version of these interviews, Maurice Müller's recollections of his life—its difficulties and successes—in his own words. His account of how he revolutionized the treatment of fractures, improved reconstructive surgery, and pioneered total hip replacement is vivid and immediate. Of course, the interviews were his version of history. Undoubtedly, others will have their versions, but since Müller was the prime mover in the operative treatment of fractures, the man who articulated the principles of osteosynthesis and whose vision resulted in the steps which led to the organization of the AO, his version is critical. The interviews allow us to hear his voice and to appreciate his character, determination, discipline, vision, and technical genius, as well as his supreme self-confidence. Maurice was unacquainted with modesty, but he also had little reason to be modest about his achievements.

The text preserves the format of our interviews. I ask leading questions and Professor Müller responds, often in long, elaborate responses, in which he describes the development of his ideas and achievements and adds personal anecdotes that add flavor and color to his story. The interviews were conducted in German. My English translation of Professor Müller's words has been edited to remove repetition and redundancies and to organize his story in a temporal sequence. Interspersed throughout, in italics, are my observations, which I have included to clarify or explain his statements. I dispensed with the interview format in the last segment of Maurice's life story and summarized the years after our interviews in my own words.

To help the reader to appreciate the magnitude of the accomplishments of Maurice and his close colleagues, I have included a brief history of how fractures were treated until the middle years of the 20th century, when the AO ignited a surgical revolution.

## Letter from Maurice to Joe

Professor Dr(med) Maurice E Müller  
Melchenbühlweg 9  
CH-3006 Bern  
Bern, April 6, 1998

My dear Joe,

The lecture and slides you delivered on my 80th birthday were unparalleled, and I am short of words to adequately express my thanks. My congratulations!

Your lecture has convinced me that we should collaborate and write a book which would be of interest for generations to come. The gift you and Valerie gave me, *Looking for Ghosts*, painted by the indigenous painter Michael Robinson, hangs in my bedroom and will long remind me of my 80th birthday.

You have certainly been my best North American student; I am proud of you. I hope that now as you become president you will be able to accomplish something exceptional for the AO. You have my full support. Soon I am going to move with the times and have an email account. That will make things much simpler.

Affectionately yours,



Professor Dr(med) Maurice E Müller  
Melchenbühlweg 9  
CH-3006 Bern  
Bern, April 6, 1998

Mein lieber Joe,

Dein Vortrag und Deine Dias waren absolut einmalig, und ich kann Dir kaum adäquat danken und gratulieren!

Damit hast Du mich überzeugt, dass wir zusammen ein für die spätere Generation interessantes Buch schreiben können. Auch das Bild von Dir und Valerie "Looking for ghosts" vom Indianer Michael Robinson wird mich noch lange an meinen 80sten Geburtstag erinnern. Es hängt schon in meinem Schlafzimmer.

Du warst sicherlich mein bester nordamerikanischer Schüler, und ich bin stolz auf Dich. Hoffentlich kannst Du auch in der AO etwas Aussergewöhnliches machen! Jedenfalls hast Du meine volle Unterstützung. Bald geht's weiter, und ich werde demnächst einen E-mail installieren. Dann wird auch alles einfacher.

Ganz herzlich Dein,



## *Acknowledgments*

I am grateful to my wife Valerie for her assistance with this project. Having had considerable experience as an oral and published historian, she helped me conduct many of the interviews and edited my manuscript.

I am also grateful to Janine Aebi-Müller, who graciously provided the photographs that accompany the text. Ms Aebi-Müller also reviewed the book for accuracy regarding the Müller family history.

I greatly appreciate the support of the AO Strategy Fund and the AO Education Institute, and especially the assistance of Vidula H Bhoyroo, the project manager of this publication.

The portrait of Maurice E Müller that introduces each twenty-year section of his life was contributed by the Kindermuseum CREAVIVA/Zentrum Paul Klee, Bern, Switzerland, to honor the 100th anniversary of his birth.



## *A brief history of fracture treatment in the first half of the 20th century*

Two of the most influential surgeons to treat and write about fractured bones in the first half of the twentieth century were Lorenz Böhler in Austria and Sir Reginald Watson-Jones in the United Kingdom. From his experience in treating fractures during the First World War, Böhler developed his principles of closed treatment of fractures and rehabilitation of patients. He incorporated his method into an efficient system which allowed him to care for a great number of patients simultaneously. After the First World War, he became head of the first Accident Hospital in Vienna and in 1929, published his influential book, *The Treatment of Fractures*. Sir Reginald Watson-Jones, orthopedic consultant at the Shropshire Orthopaedic Hospital in Oswestry from the late 1920s, published his book *Fractures and Joint Injuries* in 1940, which became known among surgeons in the English-speaking world as the “bible.” Both Böhler and Watson-Jones were champions of nonoperative treatment of fractures. The results they achieved were the best that closed surgical treatment had to offer.

Operative treatment of fractures began with cerclage and then plating. The first plate for the immobilization of bone appeared around the mid-1880s. Although advances in the design of plates in the following years were numerous, these implants offered few advantages, since there was no progress in the technique of their application. An open reduction and internal fixation not only risked sepsis but also still required immobilization in a cast because of the instability of the fixation. Patients suffered major complications, stiffness most of all, but also failure of union, and infection. Operative treatment seemed to offer the worst of both worlds: the usual risks of surgery and the even greater risks of serious complications. There were exceptions. Fractures of the femoral neck and intertrochanteric fractures were treated by open reduction and internal fixation, not because operative treatment was successful but to save lives. Conservative treatment meant certain nonunion in neck fractures. For the elderly, prolonged bed rest and cast-immobilization resulted in such high-mortality rates that surgery, to make early mobilization of the patient possible was undertaken, despite its risks, in the hope of survival.

Gerhard Küntscher was not the first to attempt intramedullary nailing but his nail design and technique which he introduced at the beginning of the Second World War were revolutionary; they allowed him to make major strides in advancing intramedullary nailing of long-bone fractures. Wide interest in Küntscher's nail was ignited when American prisoners of war, who had been treated with his technique, returned. It became apparent that intramedullary nailing made it possible to dispense with traction and cast-immobilization and permitted restoration of normal function. Some American surgeons designed their own nails, but since teaching of surgical techniques at that time was almost non-existent, other surgeons were unable to replicate their success. Failures became common and the technique fell into disuse.

“*Today, the AO standard of treatment and the AO philosophy and methods are no longer viewed as revolutionary, dangerous, irresponsible, and evidence of malpractice. Today they are the standard of care. Maurice Müller had a vision which has become reality.*”

Until the middle of the twentieth century, fractures of long bones, such as the tibia, were treated in most centers in long-leg casts, which were changed into below-knee plasters after six weeks or later. Weight-bearing was rarely begun before ten or twelve weeks after injury. Patients with fractures of the tibia rarely regained normal ankle and subtalar motion and often healed with axial and rotational deformity, and sometimes with unacceptable shortening. The ravages of prolonged plaster immobilization led some to speak of the complications as “plaster disease.”

Fractures of the femoral shaft were treated, almost without exception, in traction for periods ranging from twelve to sixteen weeks or longer, the duration depending largely on the appearance of callus and stability of the fracture. The end of traction signified the transfer of the limb into a hip spica cast and from it into an ischial, weight-bearing, long-leg caliper, in which the patient could gradually begin to increase loading of the extremity. Treatment was almost never over in six to eight months. Apart from complications of prolonged bedrest, which were far from trivial and at times resulted in death, most patients with fractures of the femur would still receive physiotherapy at twelve months or more to mobilize their stiff knees and strengthen their weakened and atrophied muscles. Permanent invalidity was very high, even in those patients who did not incur a complication during the process of treatment.

Fractures of the humerus were treated for a minimum of three months in a long-arm cast extending from the axilla to the hand. Fractures of both bones of the forearm were treated, at first, in a long-arm cast extending from the axilla to the carpometacarpal joints of the hand. If treatment progressed satisfactorily, some were transferred to a below-elbow cast to allow mobilization of the elbow, but forearm and wrist immobilization continued. Permanent stiffness of the wrist was common and the loss of supination and pronation the rule. Occasionally, if reduction could not be maintained, intramedullary fixation with K-wires or Rush pins was attempted, but plaster immobilization had to be continued and the outcome of treatment was not improved.

The same form of treatment was given to patients who had intraarticular fractures because open reduction and internal fixation offered even worse complications, particularly stiffness. The fixation was never sufficiently stable and plaster fixation had to be used to prevent displacement or loss of fixation, or both. A displaced, intraarticular fracture guaranteed invalidity in the form of stiffness, pain, and posttraumatic arthritis.

The outcome of treatment of open fractures was much worse because of the associated soft-tissue injuries, which resulted not only in an unacceptably high incidence of infection but also in a much greater incidence of all complications associated with plaster immobilization.

Any reconstructive bone surgery, which necessitated an osteotomy (the transection of the bone) with or without attempts to provide some form of internal fixation, also meant postoperative cast-immobilization. Otherwise loss of position was certain and failure of union was high.

The need to immobilize broken or transected bones for long periods was associated with stiffness and swelling of the extremity even without deep vein thrombosis, which was common. Atrophy of the soft tissues was certain, as was atrophy of muscles, bone, and cartilage. Joint stiffness was equally certain. Reflex sympathetic dystrophy (chronic regional pain, syndrome type II) as a complication was not rare. In addition, prolonged bed rest produced complications which were not insignificant.

Conservative treatment of fractures also had major socioeconomic sequelae. A fractured femur meant that a patient would occupy an acute treatment bed for a minimum of three months. It was not uncommon for patients with tibia fractures to spend at least a week in hospital before discharge. Some difficult tibia fractures were treated in traction for up to six weeks before being transferred into a long-leg plaster. Thus, from a healthcare perspective, a fracture of a long bone of the lower extremity was a major burden. From a social perspective, the loss of time from work was staggering and the functional outcome frequently poor.

Evidence-based surgery was not even in its infancy. Outcome studies had not been invented. Patient-centered instruments to measure results did not exist. Statistics on the incidence of impairment or disability were almost nonexistent. Information that could provide some measure of outcome, other than morbidity and mortality rates, was available only from insurance companies which paid disability insurance for patients with fractures. SUVA (Schweizerische Unfallversicherung), the famous Swiss Accident Insurance Company, provided statistics that indicated very high, permanent invalidity following fractures of the femur and tibia, as well as any fracture involving a major joint. Open fractures of the femur were still associated with a high mortality rate as late as the beginning of the Second World War. Proper splinting in traction on a Thomas splint and a Pearson knee piece significantly decreased the infection rate, as did the introduction of antibiotics toward the end of the war. Survival improved but not the functional outcome.

External fixation had yet to find its place. It enjoyed a period of popularity around the Second World War and after, but infection, particularly of pin tracks, was a major problem; the method had very few exponents.

In North America and Europe, general surgeons undertook the care of fractures. Orthopedic surgeons treated the complications of polio or congenital and developmental deformities, like scoliosis, bone and joint infections, and degenerative disorders. Degenerative arthritis of the hips and knees was as much of a problem as it is today, but surgery had little to offer. Arthritis of the hip was treated by means of intertrochanteric osteotomies. The McMurray intertrochanteric osteotomy was still performed but immobilization in a hip spica, as practiced by McMurray, was no longer used. When splines were developed (Cassel, Wainwright, Jewett, etc), most surgeons relied upon them for the fixation of intertrochanteric osteotomies, but immobilization was poor. One could not plan an exact procedure, since splines did not offer secure fixation of the proximal fragment. Not only was the position of the fragments difficult to control but the incidence of nonunion was also disturbingly high, sometimes reaching almost 50 percent.

Osteotomies around the knee were still immobilized in long-leg casts for control of position and immobilization of the fragments to secure healing. Occasionally, bone staples were used but these offered poor fixation, and casts continued to be used as the principal means to supplement fixation.

North American practice did not differ from British, as the English-speaking world shared the state of the art through publications and personal contacts. In North America, biomechanics, the science of the application of engineering principles and knowledge to bone as a structural material, was in its infancy. Friedrich Pauwels from Aachen, Germany, had published a major treatise on this subject before the Second World War, but his work had not been translated into English. Pioneers, like Karl Hirsch in Gothenburg, Sweden, were beginning to investigate and teach biomechanics, but because Hirsch was mostly interested in the spine, his concepts were slow to be applied to general orthopedics. Men like Albert H Burstein and Victor H Frankel were the American pioneers of biomechanics, but their work was slow to be accepted and initially had little impact on general knowledge and practice.

Internal fixation was in its infancy. A major textbook on operative orthopedics, *Campbell's Operative Orthopaedics* published in 1961, had only three pages on the principles of internal fixation of fractures. Surgical treatment of fractures was held back initially by the development of asepsis, subsequently by metallurgy and its application to surgery, the slow development of anesthesia, and finally the absence of antibiotics. However, most of these hurdles were overcome by the end of the Second World War.

During the Second World War, except for Küntscher, there was little progress in fracture care. Conservative or even ultraconservative measures were considered the only treatment. Even the brilliant surgeon Sir John Charnley, in the third edition of his classic book *The Closed Treatment of Common Fractures* published as late as 1961, understood that joint fractures could be reduced and maintained only by internal fixation, but that the methods were still so inadequate they could not be recommended. The world in which Maurice and his colleagues began to disseminate their message of operative treatment gave them a very hostile reception.

It is difficult to imagine that the above was the standard of care just over sixty years ago. Maurice Müller and his colleagues started a surgical revolution that changed it all. Today the AO standard of treatment and the AO philosophy and methods are no longer viewed as revolutionary, dangerous, irresponsible, and evidence of malpractice. Today they are the standard of care. Maurice Müller had a vision which has become reality.





*The first 20 years*

## *Interview with Maurice E Müller*

### *The first 20 years*

#### Family background and childhood

**Joe Schatzker (JS):** Maurice, when you turned eighty you told me that you divided your life into twenty-year periods. Let's begin with the first twenty years of your life. What can you tell me about yourself and your family?

**Maurice E Müller (MEM):** I was born on March 28, 1918, in Biel (Bienne) in the same house as my father, a very beautiful house on the shore of Lake Biel just outside the city. We lived between the hills and forest on one side and the lake on the other (**Fig 1**).

In 1850, the railway to Biel arrived. All food and goods came by rail. They had to be off-loaded and stored, then distributed by horse and cart. My grandfather, a German Swiss, had come to Biel around 1873 from Volkertswil in Canton Zürich. My grandfather's father owned a mill, hence the family name Müller. My grandfather was the youngest in the family, but having a good business sense he asked his father to help him move to Biel to start a business. It was very successful and my grandfather became well-off. He bought most of the land on the shore of Lake Biel. I still remember from my childhood the size of his business enterprise, the large building and all the horses and carts. But the arrival of the car in the early years of the twentieth century proved to be the company's death knell. Things began to slow down a little at first, but as the car became more and more popular after the First World War, they deteriorated further. My grandfather was also getting old and needed help.



**Fig 1** Maurice's childhood home in Biel, Switzerland.



My father Moritz was born in 1890 (**Fig 2**). He was a great athlete, a rower who for ten years was the Swiss rowing champion and for one year the European master. In Switzerland in those days, only the oldest son could inherit the parents' estate. The younger ones got nothing. My father was the youngest in a family of six. Realizing that he would have no inheritance, he said to his father when he turned fifteen, "Since I have no future in Switzerland, I would like to go to the United States where my oldest sister lives." She was married to the Swiss consul and lived in St Louis, Missouri. "I want to go there to study. Will you help me out financially?" My grandfather agreed to help on one condition: that in case of a war in Europe my father would come back to serve in the Swiss army. In 1905, he was given 200 Swiss francs, a lot of money in Switzerland, but worth only fifty dollars in the United States. Thus, from the very beginning he had to find a part-time job to pay for room and board. He got a job in a hotel washing dishes and during the summers, he worked in California for General Sutter, one of the first Swiss to mine gold. My father managed to get by; he finished high school in two years and at seventeen was ready to start university. He decided to study medicine.

Since, it took only three years at that time to finish medicine, he was a medical doctor in 1910 at the age of twenty. He opened an office but spent only half of the day in it. He spent the other half studying to become a surgeon. To keep his word to his father that he would serve in the Swiss army, he came home during his holidays in 1911 to attend officers' school. He became a junior officer in the cavalry, then returned to the United States to continue his practice and studies. When the First World War broke out in 1914, he excused himself at first from returning home to serve in the army, but with the second mobilization in Switzerland in 1916<sup>1</sup> and the United States' declaration of war around the same time,<sup>2</sup> he no longer had an excuse. He returned to Switzerland and soon after, began his service in the cavalry.

1 During the winter of 1916–1917, Switzerland increased the size of its army from 38,000 to more than 100,000 men.

2 The United States declared war on Germany on April 6, 1916.



**Fig 2** Baby Maurice with his parents.

He met my mother Violette Huguenin when his small unit was assigned to guard a church in Biel where a concert was being held. She was playing the violin in the concert in that very church. I have no idea how they talked to one another because my mother spoke only French and Italian and he spoke only German and English. But they did communicate somehow and soon decided to marry. Both their families opposed the marriage. He was a German Swiss and she a French Swiss. Both sides were steeped in their traditions and culture, yet despite the families' opposition, the young couple prevailed. Once they married, my mother had to move into the house of my grandfather, according to the custom of the time. But despite living in the home of a German Swiss, my mother, who had a strong personality, insisted that French be the only language in the home. My father had to learn French. The families of my mother and my father never mixed, since my mother would not allow anyone into the house who spoke German. We spent Christmas and other holidays with the French side of the family. My father's family had little to do with us.

After serving in the Swiss army, my father found himself faced with the fact that my grandfather's business was failing, and that because he was aging he needed help from his children. However, not one of my father's siblings had any desire to become involved in the business; they knew only how to spend money not earn it. Instead they put pressure on my father to save the situation. Even though he was the youngest, he was the most dependable and hardworking. He realized that his dream of becoming a surgeon had come to an end. To resume his medical studies in Switzerland, he would have had to repeat his high school year as well as university studies. Instead, he became entangled in the family business. When I was twelve I remember my father, bitter and disappointed, burning all his medical books. When I saw how upset he was, I vowed that I would study medicine and become a doctor. I never swayed from this decision.

My mother's great-grandfather came to Biel from Neuchâtel in the French-speaking part of Switzerland, where watch-making was one of the main industries. He started the first watch factory in Biel. In seventeenth century Switzerland, watch-making was still a cottage industry. Watches were made by families in their homes. They bought the parts, assembled the watches, and then sold them. Originally about 2,000 Huguenots came to Biel from Neuchâtel to develop the industry. Everyone was very happy when the Huguenots came, since Biel had no industry at that time. Originally the city was German-speaking, but soon it became bilingual. However, the two communities did not mix. A German Swiss would not think of marrying a French-speaking Swiss.



My mother's family name was Huguenin. They were Huguenots<sup>1</sup> and their watches were called Huguenotten. Her grandfather had Italian blood from his mother. Because he died young, she never knew him but her Italian ancestry likely explains my dark complexion. My mother was the youngest in her family; she was brought up by an older sister. In those days, young children rarely had parents for long, as many mothers died early in childbearing. Families and family relations were different. Another great-grandfather had a child with his first wife, who died. Since he needed a woman to run the household, he wrote a letter to his brother, who was still in the family home, to ask that he find a wife for him, around twenty years of age. When his brother responded that he had found someone suitable, he traveled home and married her two months later. There had to be a woman in the house. It was as simple as that.

My father made his decision to remain in Switzerland; he signed an agreement with his siblings and took over the family business as the sole owner. With the increasing number of cars after the First World War, my grandfather's distribution company was declining rapidly. Observing this, my father wound up the business and started a new factory in 1927 that specialized in printing logos or patterns on packaging paper. He was disciplined and worked hard; the business thrived, and we were well-off.

### Youth

**MEM:** When I was six (**Fig 3a–b**) I had to go to school. The school year started in April. Since I was born in March, I was the youngest and smallest in the class, but despite that I was always the leader in the group. My father was also a strong leader. As I became older, he and I realized that even though I was the oldest, I would not be suited to take over his business. This did not mean that I did not have a good head for business. It just meant that with our strong personalities, we would not get along in one company. He was not particularly keen that I study medicine, but once I decided to enter medical school he helped me out financially.

I was not what you would call a good student. I was good only in some subjects, particularly in those which involved memory. Later, I did well in physics, mathematics, and algebra. I was poor in languages but since I had a gift for memorizing, I learned French poetry by heart easily. To this day I can recite, for hours, poetry which I memorized in my high school years. I also studied High German at school, but only as a foreign language, like Latin. In the early years, I did not do well and had to work very hard to pass from grade to grade. Then it was time for university.

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1 Huguenots was the name given to French Protestants who were inspired by the writings of John Calvin. In France, Catholic persecution of the Protestants escalated into the Wars of Religion, fought between 1562–1598. The wars ended with the Edict of Nantes in 1598, which reinstated Huguenots' civil rights. During the reign of Louis XIV, persecution of Protestants started again and culminated in the Revocation of the Edict of Nantes in 1685. Thousands of Huguenots fled to other countries. Many settled in the Swiss cantons, like Neuchâtel.

My father never played games with us children but pushed us hard to participate in both summer and winter sports, particularly skiing. My father rowed and made sure that I rowed as well. While at school, I was the coxswain in a long narrow “coxed four,” but my father always rowed a “double” without a coxswain. I lacked the necessary strength in my arms and legs to be good at rowing, but I was light and perfect for the job of coxswain.

Our family never took holidays with my father. That was the custom in those days. I always went with the family but without my father. He almost never took a holiday himself. He traveled a lot on business, mostly in Switzerland. He was a car fanatic and always wanted to have the fastest car in Biel. He was strong, athletic, and socially popular. My mother suffered because he was popular with women. He never brought a woman friend home, but she suspected that he had had an affair with the wife of his best friend. She did not know how to handle the situation and in her anguish and unhappiness she retreated more and more into religion and became almost a religious fanatic. She was also frequently ill. She had contracted jaundice when she was young; she had a huge liver, as hard as a stone, and was always sickly.



**Fig 3a–b**

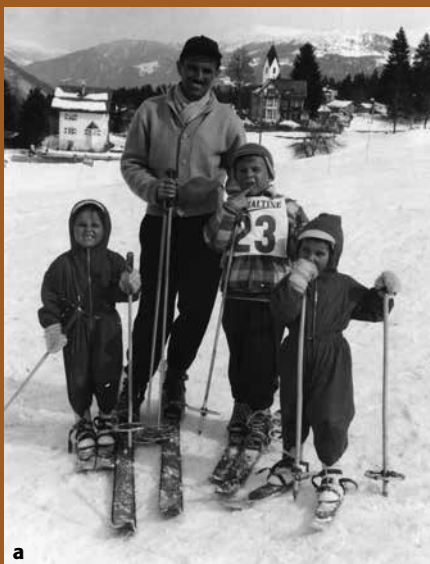
**a** Young Maurice.

**b** The young Maurice with his mother and siblings.

When I married, I wanted to spend time with my three children, Jean-Pierre, Janine, and Denise. We were together every Sunday and during the holidays (**Fig 4**). We used to rent a chalet to ski during the winter (**Fig 5a**). Despite that, my wife Marty always thought that I did not spend enough time with them. Nevertheless, the children were happy. They wanted to have time to follow their own interests. I taught them climbing, since I had trained as a mountain guide, and they were all eager to learn that skill. Their own children grew up to be great athletes and became ski teachers at a young age. All the children of my daughter Janine are ski teachers as well. It runs in the family (**Fig 5b**).



**Fig 4** Maurice with his wife, Marty, and children.



**Fig 5a–b**

- a** Maurice skiing with his children.
- b** Maurice in his 80s on skis.

My mother was born in 1894 and died at the age of eighty-eight in 1982. My father was four years older, born in 1890. He died in 1972 at the age eighty-two ten years earlier than my mother (**Fig 6**). Toward the end of his life he was deaf and withdrawn. It was difficult for my mother to look after him, but she never complained. My mother lived ten years longer, despite being delicate and frequently ill during her life. But she lived long enough to hear my retirement speech in 1980 with all the honors heaped upon me on that occasion.

### Marriage

**JS:** You married Marty in 1946?

**MEM:** Yes.

**JS:** As your mother grew older and had grandchildren, did she remain as strict about her insistence that only French could be spoken at home? Did your wife speak only German?

**MEM:** No, Marty also spoke French. She had a great talent for languages even though she came from a canton where only German was spoken. She attended commercial school; within two years she mastered French and spoke it beautifully without an accent.

**JS:** Did the two of you speak French at home?

**MEM:** Yes, we did until we moved to Zürich. I was working at Balgrist Clinic and we lived nearby. Balgrist was on top of a hill overlooking the lake. One day my first-born Jean-Pierre disappeared. We were frantic. A few hours later we heard that a boy had been found near the lake below by the railway tracks. It was Jean-Pierre. When he was found, he said that he had tried to run away, back to Fribourg where everyone spoke French. Jean-Pierre said that whenever he went out to play with the other boys they would beat him up because he could not speak German. From that day on, we began to speak German at home. Once he picked up the language everything was all right.



**Fig 6** Maurice's parents—Moritz and Violette Müller.

**JS:** Maurice, you came from the French culture and spoke mostly French. Why did you marry a German Swiss?

**MEM:** Marty came from the countryside near Linden where only German was spoken, but she charmed my parents because she spoke French so well and because she was a fine cook. She was extremely capable. One day while we were still in Biel, I invited fifteen fraternity brothers to dinner. I told Marty at noon that I had invited them. She took command of the situation and arranged everything so quickly that my parents were astounded. She charmed my parents with her many talents; they were overwhelmed.

Marty came from the countryside where women were usually the bosses. Marty's mother was that like that, very strong minded. Her father had nothing to say at home. He was a big landowner and an animal dealer. He was famous for having the knack for picking out cows who would bear good offspring. That was an inborn talent. He had no formal training but in his business, he was king. He bought the right animals and because of his reputation sold them again for profit. They were very well off and lived in Linden on the border of Emmental.

**JS:** Did the two of you meet there?

**MEM:** Yes, we did. You know, in Switzerland in those days about 50 percent of couples met when the men performed their obligatory military service. Now imagine—we usually had to spend weeks isolated in the mountains in snow and ice. At the end of this service, when we came down we were easily charmed by the local women who seemed to have a gift for entertaining the men with food. In those days when contraception was not available, young women did not want to get pregnant. They wanted to marry at a young age and have children.

I met Marty when I was in military service (**Fig 7**); I came down from the mountains after a stint of six weeks and lived in the countryside in Linden in a room which I rented from a very nice woman. Once I asked her if she knew any attractive girls. She said, "Oh yes, I have a niece who is always with university students. She speaks French fluently and is very vivacious." A couple of days later, her niece came to Linden and we met. I saw how she rode her bicycle—like a fury. That appealed to me. I followed her, and we started up a conversation. I think I even bought her coffee. Then we said goodbye and she disappeared.

Two days later I got a telephone call. It was Marty asking me to come and declare someone dead because the local doctor was away. I was not yet an officer, but I had a diploma which certified that I could work as a doctor, even though I had not yet finished my studies. When I met up with her, Marty was making sure that the dead woman was properly washed and dressed. Because she had worked for a doctor as a laboratory technician, she could ascertain that the woman had died. I was impressed with her ability and efficiency. Afterward she invited me to come and have coffee at her house, which was next door. I met her mother on that occasion. After that we corresponded a little; three months of silence followed.



**Fig 7** The young Maurice in his university days.



My next stint in military service was in Thun; I lived in the army barracks. When I arrived there around 11:45 a.m. I saw Marty with another man. What surprised me was that I was jealous. On another occasion, when I spent about an hour with her father, I learned that the man was her cousin from France. When I served again in the army, I managed to see her once or twice. Once I came on horseback. Marty was giving a party for the officers. When I saw her surrounded by all the men, I wanted very much for them to disappear. When they finally left, I had an hour with her alone. And then—well, you know how it is in the country. When I appeared again, she had made inquiries and knew all about me. Then there was a kiss, and all seemed to be sealed. That was in 1942. It was quite a while before we finally married in Ethiopia in 1946. I think Marty, who had worked as a lab technician with a doctor, had wanted to marry a doctor all along.

I was living in Lausanne at the time and was still going to university. I had many other girlfriends, but after I became interested in Marty and wanted to marry her, she seemed to have no interest and held out. In 1945, when I started to work at Balgrist, Marty's mother suddenly died of subacute endocarditis. In those days when penicillin was not available, it was a fatal illness. Marty was the oldest of five children in her family, just as I was the oldest in my family. In Switzerland, when the parents die the oldest becomes head of the family. Once Marty's mother died, things changed. In 1945, we spent our holidays together; I proposed but she still did not want to marry. I told her then that I would be leaving for Ethiopia and that if we were going to marry, I would have to introduce her to the authorities before I left. I had to press quite hard for her to make up her mind. I went so far to impress her that I showed off all my magic tricks. She knew that I had helped her mother while she was ill, and although initially her mother had been against me, toward the end she came to like me. And so, Marty finally agreed, but we still had to wait until I was in Ethiopia. She came to join me and in 1946 we married (**Fig 8**). We returned from Ethiopia in late 1947 when Marty became pregnant.



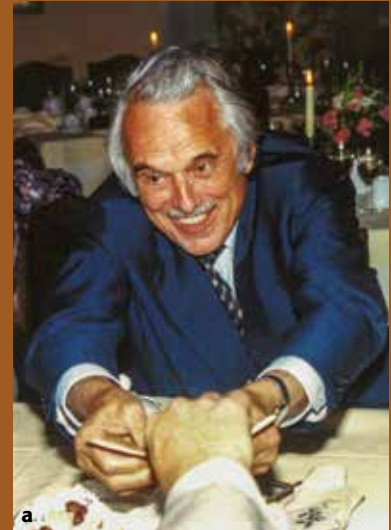
**Fig 8** Maurice and his wife, Marty.

## Lausanne

**MEM:** As you recall I started my studies in Neuchâtel in 1936 and went to Lausanne in 1937. Immediately I joined the medical fraternity which belonged to the Falkensteiner Bund, a group of four fraternities. In Bern, the fraternity chapter was called Falkenstein and in Lausanne Valdesia. Each of the four had its own name.

While in the fraternity, I went with a male friend to a mountain hut to study for my exams. While in the hut I found an old French book, published in 1875, about magic and all sorts of tricks, including hypnosis. All the card tricks described in the book depended on distracting the onlookers, but even more on manual dexterity. My friend tried them but was not able to do them. He lacked dexterity. Somehow, I was very good; I practiced a lot and I became better and better.

In the evenings, we would go to the local pub in the village where I charmed the local people with my different tricks. I learned how to shuffle cards so that I would always know where a certain card was. One day I came to the pub when a group of locals were playing cards. I joined them. They had all the aces in their hands and thought that they were going to win, but I had the trump card and they lost. We continued to play, and they lost again. They could not understand how I could be so lucky to get the trump card again and again. Then I showed them a few more tricks. A few days later, I heard that they were beginning to talk about the “dark devil” who came down from a hut at night to play cards. I think they called me the dark devil because of my dark complexion. I learned more tricks and kept getting better and better. The magic tricks I learned served me well during my life. They taught me that when you learn something you must always ask yourself how you can make it better. I would learn a trick and then see how to improve it. Magic tricks were truly magic when they served as an ice-breaker at parties or helped me when I was invited to other countries. If I found myself at a gathering in a strange land where communication with those present was difficult because of the language barrier and different customs, after an hour of my tricks people were usually ready to eat out of my hand (**Fig 9a–b**).



**Fig 9a–b**

- a** Maurice, the magician, performing magic tricks with cards.
- b** Maurice untying rings.

Early on I learned a lot about business from Alfred Borter, a cousin in Lausanne who was a lawyer. He was very inventive; he had made all sorts of small discoveries but did not know what to do with them. I proposed a partnership. That was in 1939. We called the company Fixta. Initially, we had eight or nine things we were trying to sell. What proved to be a great success was a tie holder that held the tie to the shirt. There was no such thing available in those days. We were very successful. We started the company with 5,000 francs. I put in 500 francs and he put in 4,500 francs. We had four salesmen and went to all the fairs and exhibits. Suddenly I had money. We made 3,000 francs. We paid fifty cents for each tie holder and sold it for 1.50 francs. With the money we earned, we bought new stock and had about 10,000 tie holders. Then suddenly on September 1, 1939, mobilization was announced, and we had to put our stock in the cellar. When I returned months later, all the tie holders were rusty from the moisture in the cellar and were unusable. Despite the loss, I learned very important things from this enterprise, such as how to manufacture things, the importance of packaging them, and how to patent them. This business experience and magic were the most important things I learned besides my studies. The business principle I learned was that before you can have something, you must produce something. This was the principle I used when we founded the AO. The producer we were going to work with had to be ready to produce before he got paid.





*The second 20 years*

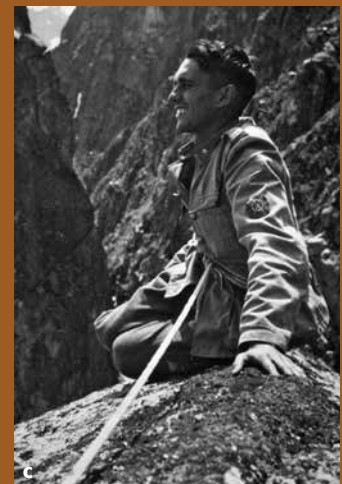
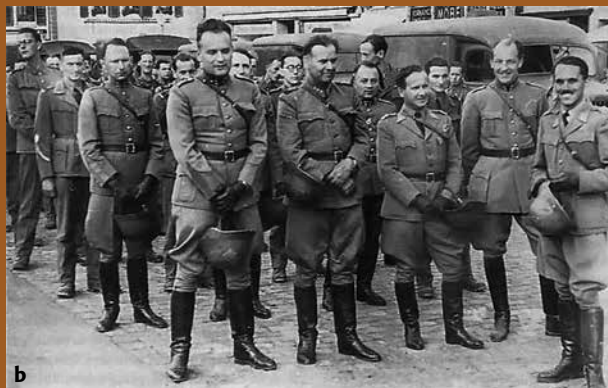
## The second 20 years

### Military service

**JS:** All Swiss men must serve in the army. I believe you served in Andermatt<sup>1</sup> as a soldier and in Wallis<sup>2</sup> as an officer. Is that correct?

**MEM:** I first attended the school for recruits in Andermatt in 1939. After general mobilization, I served for six weeks until mid-October, attended a review course in the mountains in Simmental,<sup>3</sup> and then the school for junior officers in Basel. In 1940, I received two distinctions from the army: a distinction in mountain climbing with a High Mountain Certificate, and at the same time, the title of *Wachtmeister* (sergeant), and a position as an independent physician for a company. The High Mountain Certificate allowed me to work as a mountain guide, and since I had these extra qualifications, I was also better paid. In the evenings, I used to practice my magic and entertain the soldiers. There were other advantages, like not having to pay to ski. In 1944, I served in Canton Basel and had to ride a horse. I attended officers' school in the city of Basel and then served in the district. I became a lieutenant in 1944. During my annual service, I was always a doctor with a different company. In 1958, I finished my military career after twenty years as an independent physician, and the last time I served was in 1961 as chief surgeon with the rank of major. I was not able to serve longer, since I was now chief of a hospital. Chiefs were obliged to stay in their hospitals in case of war (**Fig 10a-c**).

- 1 Andermatt is a town in a high mountain valley in Canton Uri.
- 2 Wallis (Valais) is a canton in the south-west of Switzerland.
- 3 Simmental is an alpine valley in the mountains of Canton Bern.



**Fig 10a-c**

**a** Maurice in the Swiss military.

**b** Maurice leading his battalion. Maurice on the right and Robert Schneider first row left.

**c** Maurice mountain climbing in the military.



### University years

**JS:** Maurice, you were eighteen and a half, when you finished secondary school. Then you did all your medical studies in the French part of Switzerland. Beginning in 1936, you completed the first year and a half, the so-called “foundation,” in Neuchâtel. The subjects you studied there were all pre-clinical, like anatomy, chemistry, physics. When you began your clinical studies in 1937, you moved to Lausanne. What was Lausanne like?

**MEM:** I finished officers’ school on January 1, 1940, after which I had two free months. I went to Bern to attend medical school for a short time, but returned to Lausanne. From my perspective, Lausanne was preferable. Bern was German and very serious; Lausanne was French and the student life was much better.

### Lausanne 1937–1944

**MEM:** I was not a very good student. I played around a lot instead of studying. In 1937, 1938, and 1939, my friends and I spent most of our time sailing on the lake. We had very close ties with France, even as late as 1940. In that year, France fell and was occupied by the Germans. Suddenly, we Swiss found ourselves locked in and not able to move. I know what you will say about our life in comparison to your war experiences, Joe, but nevertheless, it was a terrible time for us. Our usual, carefree student life was suddenly interrupted. At the start of the war, we were suddenly given a two-month vacation. When we returned to our studies, the universities were knocked off their schedules. We would be told that we were doing one thing, and then suddenly we had to do something else. Also, we never knew when we would be called to do military service. I am happy that, in my case, the war years passed relatively well but they were difficult—terrible. Prior to the Second World War, one third of our food was produced in Switzerland; the rest was imported. And now suddenly we were cut off and had to become self-reliant. Times were tough for the whole country. We were not hungry, but things were difficult to get. We lived as if we were in a prison.

**JS:** Maurice, you told us that you had decided to become a doctor and then possibly a surgeon, but as the years pass people often change their opinion. Were you still determined to become a doctor?

**MEM:** Well, once I make up my mind I do not change. I decided to become a doctor and that was what I was going to do. There was no question. This is one of my characteristics. Such situations have cropped up many times in my life, but once I have made a decision, I never sway from it.

*[This proved a characteristic of Maurice during his whole life. He was very decisive; once he made up his mind he would not change.]*

**JS:** We know that you belonged to a medical fraternity. Why did you join?

**MEM:** Well, for one I could go skiing with my brothers in the group of four fraternities. I could speak a bit of German, so we went to ski near Davos in Bündnerland. I liked being in the fraternity and did all sort of things to impress the others—like the day when I hypnotized a rabbit. On another occasion, I got terribly drunk. I got lost but the group found me. When the fraternity had elections in March after our ski trip, I was chosen treasurer. That was still in Neuchâtel. Then in 1938 in Lausanne, I was chosen to be the *Fuchsmajor*, the one in charge of new members coming into the fraternity.

Fraternity life was full of social events. Each year we had a ball. In addition, the fraternity had a big annual get-together. Because I was the *Fuchsmajor*, the one responsible for the education of the younger fraternity brothers, I had a great advantage when it came to social life. When the annual ball came around, it was my job to make sure that each of the fraternity brothers had a date. Because I was the one to look after the dates, many eligible young women contacted me to be sure that I knew that they were available. This gave me all sorts of opportunities. I had the pick. I had many girlfriends during my studies. I was also the one to carry the fraternity colors. I became very involved in fraternity life, even to the point that my studies began to suffer.

In 1938, through my fraternity I had the opportunity to participate in a special study sponsored by the canton and directed by experts from Paris. The result of this study indicated that it would be best for me to be an architect, city planner, or surgeon, in that order, and that if I were to become a surgeon, I should specialize in bone surgery because I had a very well-developed talent for three-dimensional thinking. I was told this in 1938 before the Second World War when I was twenty and still a medical student.

**JS:** How did all that come about?

**MEM:** Three people came from Paris to demonstrate the work of their psycho-technical institute to the educational authorities in Lausanne. They proposed testing six students psychologically and technically to demonstrate their aptitudes for future professions. There were about 1,500 students in Lausanne; the educational authorities had no idea how to select six candidates for the study. The solution came from a member of one of the six student fraternities in the canton. He proposed a way that would be the simplest and most impartial. He thought that one student from each of the six fraternities should be chosen. He did not advise that the presidents be chosen because even though the presidents were usually the cleverest ones, they usually were also quite complicated people. He suggested that the members in charge of training of the young fraternity brothers would be appropriate. This proposal was accepted, and since I was the one in charge of the young fraternity brothers in my medical fraternity, I was chosen. Next, I received a letter from the authorities inquiring whether I would serve as a volunteer for this test, which would take a week to complete. All six of us were twenty at the time. Each of us had already had experience in life, since we had had some military training.

I accepted, and arrangements were made for the test. After three days of tests, all of us passed. Next, each of us had to undergo a further test based on the previous results. We were tested by the three men from Paris, who managed to make quite accurate assessments of each of us, based on the information they had obtained. When my turn came, they told me that according to the tests, they believed I was most suited to be an architect first, then a city planner, but that I was also suited to be a surgeon. After further testing and discussions with the candidates, they told me that I had a great gift in three-dimensional thinking, and because this was so important for bone surgery they recommended that I become an orthopedic surgeon.

**JS:** What were your professors in medical school like? Were they good?

**MEM:** Yes. We had exceptionally good professors once the war broke out. The majority came from France. They did not want to remain under German occupation and had escaped to Switzerland. We welcomed them and made them part of our faculties. Suddenly our Swiss university was filled with famous faculty members. For instance, we had the best dermatology professor in Europe. He had lived in Paris before he escaped to Switzerland. It is because of him that I became an expert in all the stages of syphilis. This came in handy when I was in Ethiopia, where one third of the population had syphilis. I was considered the expert consultant—all because of this French professor. The Americans gave us drugs to treat syphilis, but we had had no experience with them. Since I knew the disease well, I could assess how the patients would react to the drugs prescribed. Dermatology was never a popular subject. Before the war, the lecture room, built for 200, usually had about thirty students listening to a lecture. With our new professors, the lecture rooms were filled. Of course, the professors were excused from military service. When it came to military service, I was the chief of my medical unit in the military. I had to serve but then I was still a student.

**JS:** Were there any other famous professors?

**MEM:** We had a good professor for surgery, but he knew nothing about fractures. It was at this point in my education that I realized that general surgeons knew little about fracture treatment. Take Decker<sup>1</sup> for instance. He was a famous general surgeon in Switzerland but he knew little about broken bones. General surgeons were never that familiar with fractures in the past and it is just the same today. Look at Martin Allgöwer and his school in Basel. They were technically proficient in fracture treatment but they knew very little about musculoskeletal pathology and disease. To treat fractures successfully you must know much more than just how to treat broken bones.

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<sup>1</sup> Pierre Decker (1892–1967) was professor of surgery at the University of Lausanne from 1946 to 1957.

**JS:** How many hours a day did you have lectures?

**MEM:** We were at school most of the day but we generally attended only the few compulsory lectures. In good weather, we preferred to be sailing on the lake or skiing during the winter. Generally, lectures were not well attended. I must say that I did not attend often. With my responsibilities as fraternity treasurer, the color carrying fraternity brother, and Fuchsmajor, I had so many obligations that I almost lost a year from school more than once. The main reason was the fraternity, but I also had many other obligations. I kept postponing my exams because I kept realizing that I was not sufficiently well prepared. This, of course, stretched my studies. I started in 1936 and did not finish till 1944.

**JS:** What did your father have to say to all this?

**MEM:** Well, he had no idea. Our studies were broken up with different things like military service. I could always give good sounding excuses at home.

**JS:** What about anatomy? Did you have to dissect a cadaver?

**MEM:** No, no. We had only lectures and demonstrations. Incidentally, anatomy was not part of our clinical studies but belonged to the first part, the foundation years, which I spent at Neuchâtel. We studied mostly from prepared cadaver dissections and from special demonstrations. The laboratory sessions were run by demonstrators, not by the professors. Things were very different from today. We did not have a very detailed course in anatomy. The professor was there only to lecture from his high lectern above us. He never soiled his hands with close contact with the students in the dissection laboratories. After the war, all that changed. In gynecology, for instance, we never saw a living patient, only dolls. We had to wait a long time until we had a living female patient to examine. It was very difficult to find a woman who would allow students to examine her. The first time that I examined a woman was during a locum in Bern, which I did after my graduation.

**JS:** Maurice, in the three clinical years you spent in Lausanne, what responsibilities did you have as a student? Were you allowed to have access to patients, to examine them, and follow their treatment?

**MEM:** No! No! We were allowed only to observe but never had any direct contact with the patients.

**JS:** When the final exams came were they oral, written, or both?

**MEM:** Both. I finished medical school on April 10, 1944. I was now allowed to practice but I did not have the title of doctor. Before I could have the title, I had to write a thesis and defend it. That was at the end, after the state exams.

**JS:** Were you always firm in your decision to become a surgeon?

**MEM:** Well, as I already told you, once I make up my mind, I never change. I made the decision to be a doctor when I was twelve. Throughout my life, once I made a decision I never changed it.

**JS:** Did you decide to become a surgeon because your father was a surgeon?

**MEM:** No. He studied to become a surgeon, but he never finished his studies because he was forced to return to Switzerland to serve in the army. My father's studies in the United States were in general surgery. In Switzerland, we had to start with general surgery before we could become an orthopedic surgeon.

I was twenty-six when I finished my medical studies. We finished in April and I had a long break before I could start to specialize. I decided that before I proceeded, I would do three locum tenens and then as soon as I finished them, I would do my military service in September 1944. I still had to attend officers' school. It was only early in 1945 that I could start at Balgrist in Zürich as a junior assistant in surgery. The locums were the first time that I treated patients. I had never done it before!

### Locum tenens

**MEM:** Now imagine how things were. I was alone, I was not married, and I lived at home in Biel. I had finished my studies in April 1944 and up to that point, I had neither examined nor treated a patient. The locums, which I arranged on my own, were my trial of fire, so to speak. I was starting as a doctor, never having done any surgery or clinical work. As you can see, it was a very different world. During my life, instead of stepping into something blindly, I always tried to make plans and prepare myself—thus, the decision to do the locums.

The first was in a relatively remote valley in a mining area—full of miners. The doctor whom I was replacing warned me that I should not be taken aback if a patient would tell me that he drank ten liters of fluid a day. The miners worked underground where it was very hot. Then the doctor asked if I knew anything about teeth?

He said, “You will see a lot of patients who come with dental problems.”

I said, “I know nothing about teeth.”

Then he said, “Here are some instruments: these are for extracting teeth and this one is used if you break a root. If you run into trouble, my wife will tell you what to do.” Then he said, “Don't give any of my patients injections. Many of them are old and very sensitive to strong medications. Also, don't get upset if someone dies.”

I said, “What! I have never seen a dead patient in my life. I saw my grandfather when he died but never a dead person as a medical student.”

He said “Don't worry. You will do just fine. You have my car. I am going on holidays.”

And that was that. The first patient appeared within an hour from my start. He was a middle-aged man who came because he had terrible teeth. I had to extract not only two of his teeth but also the roots. Other than seeing the instruments when the doctor showed them to me, I had no idea what to do. The man could tell by the look on my face that this was the case.

He said “Oh yes, the doctor pulled two roots a couple of years ago. Don’t worry. You will do fine. This is the tool he used.”

And with this he pointed to my tray and the instrument. And so, it went from day to day, one adventure after another. Two days later an old lady came, who said that she needed an intravenous injection. I managed that with some difficulty. I had never done one before. Two days later she came back and told me that I had to repeat the injection. The first worked so well that she wanted another. I remembered what the doctor had said about injections, but she insisted.

Soon after she left, a man came running and said that the old woman had suddenly taken a turn for the worse. I ran to her as quickly as I could but when I arrived, I found her dead. I was horrified but her family tried to cheer me up. They thanked me profusely and said,

“Look she was ninety-three and had such a beautiful death. She suffered no pain. She just went. We are most grateful.”

Such was my life. I learned a lot. When the doctor returned, he told me that he had spoken with people in the area. They all thought that I had done a great job. He had two cars. One was like a tractor and could go up mountains. We were in a hilly area between Basel and Zürich, which in those days was quite wild. I was very grateful that he had left me such a great car to use when I had to do house calls.

After the first locum I now had eight days free, which I spent at home in Biel. Then I went to do my second locum in a small town. This was not a country practice. The town was small, almost a village, but next to a larger town. The doctor’s practice was in a beautiful house, which was just like a holiday villa. He gave me a Mercedes convertible to use and told me that he was going abroad on holidays. He had written down some directions about what to do with his patients. He said that there was no one who could help me. A woman would come twice a day to make dinner and supper, but she would not be able to assist. He said that I had to make a list of the patients who came, so that he would know whom I had seen. We were in a small town in middle of Canton Argau between Luzern and Olten. The first thing I did was to call Marty, my girlfriend. I told her that we had the use of a convertible and that I would come in three days and pick her up from the hospital, where she had just had her tonsils removed. She was very happy when I came. The practice went very well. I was gaining confidence and was having a good time. At the end, the car was still in one piece.

The third locum was in Bern; it was very different. The experience I gained there proved to be most important for the rest of my life. It not only confirmed that I wanted to be a surgeon but also allowed me to decide my specialty. When I came to the office of the doctor in Bern he said to me,

“You know my practice is not that difficult. I am a specialist for disorders of feet and veins; my practice is restricted to these two areas. You see, I had only a year and a half of training as an assistant. Then I worked in a sanatorium which was terribly boring. Now I have a fantastic practice treating only problem feet and varicose veins. I have two small books which are my bibles. One is entitled



*Foot Disorders* and the other *Veins and Their Disorders*. That is all I know, and I do nothing else. Furthermore, my wife is staying behind, while I go to do my military service. If you have any problems, ask my wife. She knows everything and will help you. She will also make sure that the practice runs properly and remains profitable since I must cover my expenses."

During my locum in Bern, it seemed to me that doctors in the city had a different approach than those in the country. In each of the three locums I was confronted with three very different mentalities and three very different approaches to medicine. The doctor continued,

"Each week I will come back for half a day from my military service. I have permission to do this because I have a specialized practice and am not just a family doctor. I also work very closely with a man who makes orthotics for shoes and gives physiotherapy treatments and special baths. He is not a doctor but a physiotherapist. You will see that it is a very interesting practice. I collaborate with this man and I always do what he says. He appears to know more than I do." And with that he left.

Well, things appeared to run well from day to day. Every day, the doctor's wife carefully checked what I did, what I charged, and how much money I took in. It was truly a most peculiar experience. Just let me illustrate. On the first day, a very attractive young woman came. She had visited this doctor before and said that she needed to be examined because she was not feeling well. She could not have been more than twenty-one years of age. I carried out a physical examination and took some blood for tests. I said that I would let her know the results once they became available. Then to my surprise she said,

"But doctor the examination is not over."

I was quite taken aback. "What do you mean?" I said.

She replied, "You see; the doctor always does a vaginal examination."

Well this presented a problem. In university, we had been taught gynecology on dolls and I had never done an internal vaginal examination on a living patient.

I asked, "How does the doctor do this internal examination?" She pointed to the special table with stirrups. "Ah," I said, "It is good that you have explained this." As I began to examine her, she gave me tips.

She said, "You see I have pain on the right side and the doctor does this and that, and so on. You see, he knows that I like this very much and he does it every time I come."

Well, that was an experience. Once I was finished she paid, and as I was leading her out the door, she turned to me and said,

"Could we meet socially?"

I replied, “I would consider it, but I am very busy and have already made arrangements to go to Interlaken on the weekend.”

To this she responded, “Oh, that’s OK. I will come along.”

It wasn’t easy getting out of this without compromising myself. It was a difficult thing to happen right at the beginning of my locum. And so, the week ran along until Thursday, when a man came; he appeared to walk perfectly well and seemed to be healthy. I asked him how I could be of help.

He replied, “I see you are a foot expert. I have come with only one question, which I would like to have answered but so far, the doctors I have visited have not been able to help. You see, I have a nail in my thigh bone.”

Imagine! You must realize this was 1944; the war was still going on. No one had heard of anything like a nail in the thigh bone.

Then he said, “This nail in my thigh bone has begun to come out. The doctors I have seen so far have had no idea what it is, nor what to do about it.”

At that time an intramedullary nail was a totally unknown thing in Switzerland. I asked him how he came to have a nail in his bone. “Who put it there and where was it done?”

He replied, “It was in Finland. You see, I served in the Foreign Legion in Africa. Because this is forbidden for Swiss citizens, I was in a quandary. I could not come back home, so I decided to go and help the Finns in their war with Russia. While in Finland, I ended up cutting down trees in a forest and had an accident at work. A tree fell directly on my leg. I ended up with a broken thigh bone. I was in agony. Every move was terribly painful and caused my muscles to go into spasm, which made the pain much worse. I was taken by ambulance to a hospital, and the first thing I heard there was a doctor speaking in German.

The doctor turned to me and said, ‘You know, you are very lucky. I see you have a broken femur—right in the middle of the bone. This is my specialty. I will come back after dinner and fix you up.’”

I asked the patient if, by any chance, he knew the name of this doctor. I knew immediately to whom he was referring. Because I had read voraciously anything that had to do with bones, I had read about Gerhard Küntscher<sup>1</sup> and his new method of fixing long bones with an intramedullary nail. At that time, it was almost a totally unknown method. I had read that Küntscher had developed this new method, while running a surgical unit in Finland that was attached to the German army, which was helping the Finns in the war against Russia. He was using his new method in a surgical unit almost at the front.

I asked the man, “Would it be Küntscher by any chance?”

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1 Gerhard Küntscher (1900–1972) first used the nail he developed in November 1939 at the University Department of Surgery in Kiel. From 1957 to 1965, Küntscher was the medical director of the Harbour Hospital of Hamburg.

The man replied, "Oh, it's marvelous that you know the name. I had forgotten it. When he saw me, Küntscher said that I lived under a lucky star because I had the very fracture that was his specialty and that he could fix it. He said that he would fix me up after dinner and that the next day I would be able to get out of bed. Imagine hearing that while I was lying in agony dreading the slightest move. After dinner, he came back. They gave me an injection and when I awoke, it was the next day.

Küntscher showed up and said, 'Let's see if you can move.'

I tried to move—and imagine, the pain was almost completely gone. I could move.

The doctor said, 'Just keep moving and I will see you again tomorrow.'

Tomorrow came and so did Küntscher. This time he forced me to get out of bed to stand up with two crutches. It was painful, but Küntscher just kept telling me to keep moving but not to put any weight on my leg just yet. As the days moved along I felt better and better. At the end of the week Küntscher told me that I had to go to Berlin to appear at a demonstration before an important surgical society meeting. In two weeks, with Küntscher's written orders in hand, his people arranged my travel by train to Berlin. Once in Berlin I was looked after almost like royalty. I was put up in one of the best hotels and nothing was spared as they looked after me. Four weeks after surgery, the day of the demonstration in front of a huge surgical audience arrived. Imagine, at four weeks I could walk with the aid of a cane and was almost free of any pain. I was there as one of thirteen patients who had had the same type of surgery and who were being demonstrated to show the success of this pioneering technique."

Imagine! I had read about this first demonstration that Küntscher had made to the sixty-fourth meeting of the German Surgical Society in March 1940. It was a very famous, memorable day.

"After the demonstration, I was still not able to return to Switzerland. I spent some time in a home for recovering German soldiers and then eventually made my way back to Switzerland."

I was totally amazed. Here was a man who had had a fractured femur, and after I examined him, I could see that he had recovered completely and had perfect function of his lower extremity. All other patients with fractured femurs whom I had seen during my studies had severe functional handicaps and were walking with considerable difficulty, frequently with a shortened extremity, an almost completely stiff knee, and a crooked leg. The treatment in Switzerland at that time was traction for three months or longer and then immobilization of the leg in a body spica cast until the bone had consolidated sufficiently to allow a gradual resumption of function. Every patient who had a fractured femur ended up as an invalid. And here before me was a man with normal function! I could barely contain myself. I explained to the man what had been done and how to remove the nail. With that he said that he was grateful because he knew someone who had been a doctor in Russia during the war who would be able to get the nail out.

A few days later, another fascinating patient suddenly appeared. The man had been waiting for me outside the office. I noticed that he sat slightly crooked on the stool. He had to use two canes when he came into the examining room. I asked how I could be of help. He answered that he had a hip problem and that he had had surgery six months earlier in Paris. They had done an arthroplasty. I knew immediately what it was because I had heard of a surgeon in Paris, who was well known for his arthroplasty technique. He used fascia lata as an interposition substance, which he inserted between the surgically prepared femoral head and the acetabulum. The patient said that the operation was nothing compared to the treatment after surgery, which had been terribly painful because he was forced to put his new hip joint through a range of motion more than once a day to preserve the regained mobility of the joint. He added, however, that despite this he was happy because he could move his leg. I asked him if he was satisfied. He replied that he felt as if he were in heaven. When I asked him to walk, he said that he could but only with two canes. I said, how can you be so happy? You cannot stand on your leg. His answer was quite convincing. He said that before surgery he was stiff, that his leg was crooked and short, and he was in terrible pain. Now he had no pain and had regained almost a normal range of motion. He had been sitting for almost thirty minutes without discomfort and had a painless range of motion. It turned out that the reason for his visit was that he wanted me to order a shoe lift because his leg was short.

When I had completed this locum, I realized that although osteosynthesis was unknown in Switzerland, I had discovered, in the first case, a perfect demonstration of what it can achieve. I decided that I had to study all that was available about the subject because I wanted to do it in the future. In the second case, I realized that I had seen a man whose surgical result was far from perfect, who was nevertheless delighted because even though his leg was short and he was not able to walk without the aid of two canes, he had no pain and almost normal mobility. I decided that I would have to devote myself to the study of arthroplasty and become a hip expert. I wanted to be able to improve the technique of arthroplasty so that patients would be free of pain and have mobility, but also be able to put weight on the extremity, which would be of normal length. I was sure that someday it should be possible to make that a reality. These two cases were among the deciding factors in my choice of my future profession, long before I had any formal contact with orthopedics.

The three locums, each lasting three weeks in the short nine-week summer, had turned a boy into a man. I had matured, and I knew what I wanted to do. Along with the result of the psycho-technical tests that I did in Lausanne, which indicated that I would do well in bone surgery because of my gift for three-dimensional thinking, the locum which I did in Bern further solidified my decision to become an orthopedic surgeon and specialize in osteosynthesis and hip arthroplasty. It gave me the motivation to read and to study all that was known about these problems. I decided I would apply for a position as an assistant in orthopedics after completing my military service and studies.

In Switzerland one had to pass the state examinations before becoming an officer. I did this immediately and began my regular two months of military service in September 1944. I then stayed an extra three months to attend officers' school.

I thought that the time in the military would give me an opportunity to decide exactly where I wanted to train. In Switzerland, one started military service at the age of twenty. I was now older and had finished officer's school, which meant that my military obligations would change.

### Junior residency in surgery

**MEM:** At that time in Switzerland, there were only two orthopedic clinics: one in Lausanne, the French-speaking part of Switzerland, and the larger one in Zürich, the German-speaking part. In the late 1940s, orthopedic hospitals were long-term institutions which treated crippled children, who often lived and attended school in them. From a historical perspective, Lausanne sounded more exciting. It was near the birthplace of Nicolas Andry,<sup>1</sup> the founder of orthopedics. He was French, and the clinic in Lausanne was an outgrowth of his pioneering efforts. Balgrist in Zürich was the larger of the two and more important.

While I was completing my military service, I had time to consider my options. The questions I faced were: should I take up orthopedics as a surgical discipline, which was almost a nonexistent specialty in Switzerland, or should I pursue rheumatology and physiotherapy, a much more popular field. While at officers' school, I went to Zürich to visit the orthopedic clinic and the rheumatology clinic to see what my chances might be and which I liked better. I started with Balgrist, the orthopedic clinic. I received a very cold reception. They said that I must be crazy to apply for a position as an assistant because they considered only applicants with at least two years of surgical training. Then, to discourage me further, they said that there was a waiting list with nine candidates whom they had already interviewed. Things looked hopeless. After this I visited the rheumatology clinic. This interview was much more friendly and positive. After a short interview, a rheumatologist said that they would be happy to have me. When could I start? They wanted me to start in four weeks.

I was quite happy when I returned to officers' school and looked forward to one more month of military service. Two weeks later, I received a letter from Balgrist. An unbelievable set of events had occurred. All nine applicants had for one reason or other withdrawn their applications. They were now offering me a position as assistant and were hoping that I would be able to take over the position within four weeks.

I thought to myself, life is funny. At first things looked hopeless and just as I almost gave up the idea of training in surgery, a position suddenly opened. And to add to this unexpected stroke of luck, I was now going to take over a position as an assistant at Balgrist without ever having seen an operation. I think a lot in medicine happens by pure coincidence. I turned down the position with the rheumatologist, of course, but not wanting him to be angry with me, I sent him a friend of mine who was looking for a job at the same time. He took the job, trained in rheumatology, and became one of the most famous rheumatologists in Switzerland. Life has funny twists.

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<sup>1</sup> Nicolas Andry de Bois-Regard (1658–1742) was born in Lyon, France. Among his other medical writing and research, he wrote *Orthopédie*, a study of human anatomy, skeletal structure, and growth, along with instructions for correcting deformity. He coined the term “orthopaedic” from two Greek words: *orthos*, meaning straight, and *pais*, meaning child. Andry was appointed dean of the Faculty of Medicine in Paris in 1724.

When I started at Balgrist in early 1945, I was told by the chief resident that I would be the assistant to Professor Scherb,<sup>1</sup> an elderly, very famous professor, nearing the end of his professional career. As the youngest and least experienced assistant, I was really surprised that I was being assigned to the “professor.” Although he was treated with great respect, no one else wanted to scrub with him. It took a little while before I found out why. The poor man had recurrent retinal detachment. He had had several operations on his eyes, but at that time the techniques of corneal welding were primitive, and with each operation his visual acuity deteriorated. He was at an age when he should have retired but he kept pushing to stay.

Professor Scherb had become famous for his work on tendon transplantation in the presence of paralysis. Those were the days of polio; there were many patients who had lost muscle function and were in the need of tendon transfers. Most of Scherb's surgeries were tendon transfers, but because he could not see the bone, he was not able to take the chisel and make the appropriate troughs and tunnels into which he would put the new tendon. He could not thread a needle, let alone see where to make the tunnels for the new tendons. Therefore, during surgery, he would become frustrated and angry. Thus, people avoided scrubbing with him. I quickly learned his operations and was soon able to say to the professor, “I will put the chisel where you need to make a cut, and when I say hit, please strike the chisel with the mallet.” In this way, I quickly became his favorite assistant, and with time he gained so much confidence in me that he would assist me to operate on my side of the patient, after I had first helped him with his side of the patient. Because I was allowed to operate so soon after starting my junior residency, my opinion of myself became inflated and led to some unrealistic expectations.

When I came to Balgrist, the chief resident was Mme Meuli. It was rare in the mid-1940s to find a woman working in that capacity in orthopedics, but she was fantastic. Unfortunately, in the summer of 1945 she went to Yugoslavia where she contracted severe jaundice and had to resign. This happened just near the end of my first year at the hospital. When another assistant left at the same time, I thought, “Now is my big chance to move up in the hierarchy and become more senior.” When Mme Meuli left, she was replaced by a new, wonderful chief resident, a man named Kurt Nievergelt<sup>2</sup>. He had previously been an assistant at Balgrist but had left to obtain more training in general surgery and in more modern orthopedic procedures. He was a master foot surgeon and was most impressive. He also began to set new standards at Balgrist, which was now slowly beginning to change from a long-term institution to a modern surgical clinic. To see what my chances would be for advancement, I asked him how long he intended to stay. He said that he really did not know. If Professor Scherb would allow him to work toward becoming a *privatdozent*<sup>3</sup> under his supervision, he said he would likely stay at least another four years. It did not take me long to realize that my road was now blocked and that it would take a long time for me to advance.

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1 Richard Scherb (1880–1955) served as director of Balgrist Clinic from 1918 to 1950.

2 Kurt Nievergelt (1913–1990) held resident posts at Balgrist from 1938. After 1950 he had a consultant position at Balgrist and later entered private practice. He retired in 1979.

3 *Privatdozent* (PD) is an academic title conferred at some European universities, especially in German-speaking countries, to someone who holds the formal qualifications to teach a subject at university level. It corresponds to some extent with a PhD.

Life at Balgrist was challenging and interesting, but only up to a point. Balgrist clinic was steeped in old orthopedic traditions and conservative thinking. There was no one there who pushed at the frontiers. Somewhat disenchanted with the situation, I was pondering my future toward the end of 1945 when, by chance, I saw an advertisement in the newspaper. Five positions were being advertised in Ethiopia for surgeons who would volunteer to work in the local country hospitals. This advertisement fired up my imagination. I had dreamed of working in Africa. As a teenager, I attended Sunday school taught by a woman who had been a missionary nurse in Africa with the Coptic Christians. She filled my imagination with all sorts of stories and told us of the many sick and suffering people there and the great need for help. She kept repeating that there was potential in Africa for young surgeons who would find adventures and opportunities to do good.

Just as she had fired up my imagination as a boy, this advertisement came just as I was becoming restless. It was something I could not pass up. We had been shut in for five years in Switzerland during the war, not able to travel. The war had just ended in May 1945 and now this great opportunity appeared to work overseas, travel to Africa, and work as a surgeon. I applied with little hope, since the advertisement stated that they were looking for experienced surgeons at the level of chief resident. As it turned out, I was lucky again. A surprising number of doctors had applied and from those they had already chosen five chief residents. However, soon after being appointed, they began to fight about seniority and position, and one of them resigned. They decided to replace him with two more junior assistants. I thought I had a good chance and that my ability to speak French would be a great advantage in Ethiopia.

By December 1945, I was notified that I had the job and that we would be leaving for Africa in April 1946. This threw me into a panic. I had thought that I would have a couple of years to do my thesis for my Doctor of Medicine. To complete it, I was supposed to analyze the EMG results from treadmill studies, a favorite subject of Professor Scherb. That was supposed to take about a year. Now I suddenly had only three months during which to do a study and write a thesis.

Balgrist had a great collection of x-rays going back to the early 1900s, when hip pathology was very much in its infancy. In the early 1900s, tuberculosis of the hip was very common. In 1910 and 1912 conditions like Legg-Perthes were not well differentiated and were often confused with hip infections. In this way, some children with Legg-Perthes disease were segregated in sanatoria and their hips were treated with bedrest. I hit upon a great idea. I would sort the massive collection of x-rays labeled as hips, but take only those cases with available x-rays that had a minimum of a twenty-year follow up. This reduced the cases to a manageable number. Since many x-rays were still on the original glass plates, which made handling cumbersome, I hit upon a new idea which led in future years to my techniques of preoperative planning. I decided to trace the outline of the x-ray images on tracing paper. This allowed me to preserve the architectural outline, particularly of the femoral heads during the various stages of the disease. In this way, I had a phenomenal study, which proved beyond any doubt that functional treatment was vastly superior and gave much better results than prolonged bedrest and immobilization. I was also able to note that those hips, in which the head had begun to sublux and whose joint spaces had decreased,

had a bad prognosis. I had a total of eighteen cases in my study, but that was enough information for a thesis which I completed in the record time of three months. I was awarded the degree of Doctor of Medicine in April 1946.

On May 5, 1946, a day after Marty's birthday—by now she was my fiancée—I left for Marseille and then Ethiopia. Most of my friends thought I was crazy to go to Africa, of all places. They imagined all sorts of dangers; I kept thinking of all sorts of adventures and opportunities. The fact that I would have the opportunity to do “good” was most appealing.

I had a close friend at Balgrist, Dr Jean Moraz. We had agreed that once we finished training we would open a practice together. I had introduced him to my sister Violette; they had fallen in love and wanted to marry. I suggested to Violette that she wait until I returned. Of course, she knew that I was engaged to Marty, who was going to join me in Ethiopia, where we would get married.

I had been well prepared at Balgrist for this adventure. I was no longer a beginner. The times I assisted Scherb had served me well because I had the opportunity to do much more than a young assistant would normally get to do. Once in Ethiopia, I was very much on my own.

### Ethiopia

**MEM:** My fascinating eighteen months in Ethiopia provided me with experiences which served me for the rest of my professional life (**Fig 11a–c**). Ethiopia was a totally different world. Its culture was primitive. Men were completely dominant; women were treated like chattel. A virgin wife could be bought for four goats. Life was cheap and the conditions under which we were forced to work were extremely primitive. We had no trained assistants and no means of investigating patients. We treated only diseases that we could see, like elephantiasis of the scrotum or swollen foot deformities, as well as lumps and bumps. Abdominal surgery did not exist. No one had heard of diseases like appendicitis. A burst appendix was fatal.



**Fig 11a–c** Maurice working in Ethiopia in 1946.

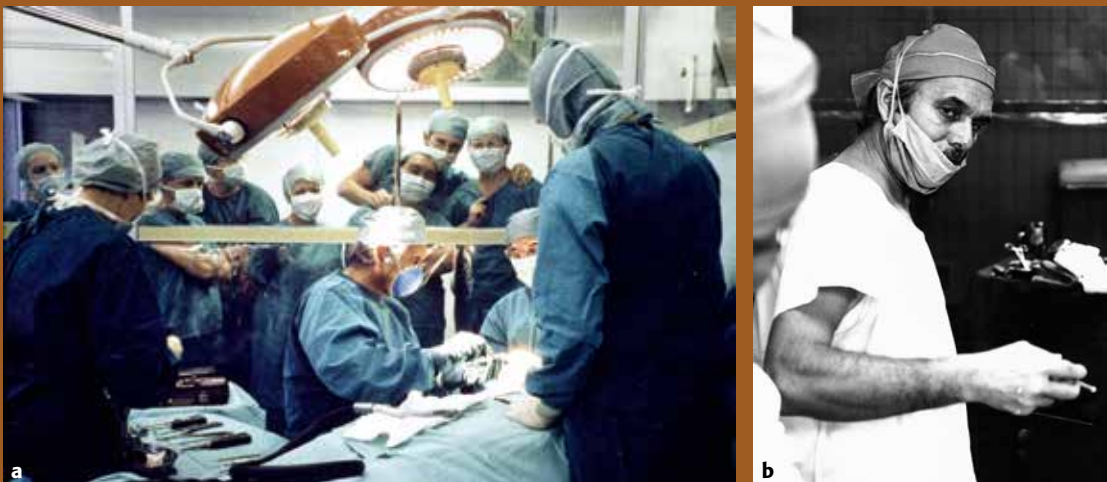


While I was waiting in Marseille for our ship, I was fortunate to be able to trade one of my Swiss gold pieces for a trunk full of medical texts. I read them voraciously; they were my source of surgical anatomy and techniques. There was no one to teach me; most of the time I was left to operate on my own. Our assistants were untrained and could, at best, hold a retractor or a light. We had to learn how to operate quickly and efficiently because every move counted. By the end of eighteen months, from April 1946 to late 1947, I had trained myself to be a skilled surgeon. I learned to examine things carefully and plan every move. I developed a personal, surgical technique of operating efficiently and deliberately. I am sure my dexterity, which was so important for my magic tricks which I practiced for hours, played a role in the surgical technique that I developed. I became a fantastically skilled surgeon who could make difficult things look simple. I could cut operating time well below 50 percent of the average time it took others to execute the same procedure. My unbelievable surgical facility also helped me design original procedures, as well as adapt procedures from others and improve them by making them simpler, more certain, and more predictable. I have the great knack of looking at someone who is operating and seeing, almost immediately, how to improve and eliminate unnecessary steps. Since I could make difficult procedures look very easy, I gained confidence and self-assurance. I was always happy to demonstrate my techniques in front of others and take on challenges that others dared not touch. This technical facility proved very useful once I began my real training. Indeed, the ability to operate so skillfully helped me throughout my life. Surgeons relate to manual skill. My manual dexterity and my habit of careful pre-planning and self-reliance helped me greatly when I demonstrated surgery to an audience. People who watched me operate said that I had two right hands. That is totally wrong. I have a right hand and a left hand, and the left is much worse than the right. I cannot even begin to think that I could do the same things with my left hand that I do with my right.

**JS:** Well, Maurice you must understand when people watch you operate, it is like watching magic.

**MEM:** OK, I understand. You might think that this is something that one might try to emulate, but it is something one can never learn. In surgery, you find individuals who are particularly gifted technically, who make things look very easy. Take, for instance, playing the violin. I cannot play a violin no matter how hard I might try and no matter how good an instrument I might have in my hands. I know that I have exceptional manual skill when it comes to surgery, but I also have another very important skill. That is the ability to see, when I watch other surgeons operate, how to improve on what they do. For instance, I watched Danis<sup>1</sup> operate and I thought to myself, “Don’t ever operate like this man.” He needed all sort of unnecessary things which only made things more difficult. He was not able to operate without his special operating table, which required the help of two skilled people. I have never used a traction table. If you need local traction, design something for local traction but don’t put the whole patient on a special device and then immobilize the limb in traction. That is why I designed my external fixator as a compression-distraction device with threaded bars. The threaded bars that I designed give it a dual function. It serves not only as a compressor but also as a distractor. Charnley’s<sup>2</sup> design, which I copied, could be used only to compress. When I saw and used his device, I knew immediately how to improve it, make it more stable, and give it two functions (**Fig 12a–b**).

- 1 Robert Danis (1880–1962), a Belgian pioneer in osteosynthesis, worked at the surgical clinic of the Free University of Brussels, Belgium.
- 2 Sir John Charnley (1911–1982) was a British orthopedic surgeon who pioneered the hip replacement operation. In 1958, he opened a center for hip surgery at Wrightington Hospital, Manchester, UK.



**Fig 12a–b**

- a Maurice in the operating room.
- b Taking a break.

### Return from Ethiopia: Liestal 1947–1949

**JS:** Upon returning from Ethiopia, why did you begin your training in general surgery and where did you train?

**MEM:** We left Ethiopia in 1947. My wife became pregnant, but she lost that child. In February she became pregnant with Jean-Pierre and she did not want to deliver a child in Ethiopia. When we returned home, my first idea was to get a job in general surgery, become a general surgeon, and only after that study orthopedics. That was also the requirement at the time.

I started in general surgery in Liestal where Dr Berger<sup>1</sup> was chief. I told Dr Berger, when I started that my final goal was to become an orthopedic surgeon and that I would stay no longer than two years. That was our agreement when he hired me. In Liestal at that time, surgery was not divided into general surgery and orthopedics. Dr Berger, the predecessor of Professor Hans Willenegger, supervised all surgical treatment for soft tissue and bone, except for ear nose and throat or ophthalmology. All over Europe, almost all fractures were treated by general surgeons. All fracture treatment was conservative. For instance, a major joint fracture of the lower extremity, such as a fracture involving the knee, would first be manipulated under an anesthetic and then treated in traction. One tried to achieve the best possible position of the fragments. Closed reduction and plaster fixation was the method used for most fractures.

Operative treatment of a fracture was rare. One might do a simple cerclage to achieve a better position of a long bone. Some clinics also used Kirschner<sup>2</sup> wire fixation for joint fractures. If closed reduction failed, one might also consider a simple cerclage for long bones and Kirschner wire fixation for some joint fractures. These were the main techniques available. At Liestal we used cerclage and K-wire fixation. Kirschner wire fixation was particularly useful for ankle fractures and for some fractures in children. For transverse fractures of the tibia or femur, we occasionally used intramedullary nails, but that was rare and would be used only if a satisfactory position of the fragments was not achieved with closed methods. All fractures of the femoral neck were treated with the Smith-Petersen tri-flange nail or the Böhler nail, since conservative treatment of these was usually fatal and if the patient survived, resulted in nonunion. On the other hand, because pertrochanteric fractures, unlike the neck, would unite in traction, they were treated in traction in bed for about four months and then in a hip spica cast. Once healed, they needed months and months of rehabilitation. Few patients ever returned to an independent level of function. In the elderly, the mortality rate was quite high, but that was the best we could do. The screw and plate combination, like the dynamic hip screw, did not become available until 1956. Once this fixation device became available for common pertrochanteric fractures, there was a significant drop in the mortality rate.

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1 Arnold Berger was chief of surgery from 1930 to 1952 at the Kantonsspital, Liestal, Switzerland.

2 Martin Kirschner (1879–1942), who introduced the Kirschner wire in 1909, became professor of surgery in Königsberg, Germany, in 1916 and in Tübingen in 1927.

Femoral shaft fractures were treated most of the time with bedrest and traction for at least three to four months and then in a hip spica for at least another three to four months. A rare exception was the transverse fracture, which was occasionally treated with an intramedullary nail. Once the bone was healed, at least a year of intense physiotherapy was needed to overcome the terrible joint stiffness, muscle atrophy, and weakness. You must understand that in those days a clinic generally knew little else than what they practiced. If they believed in osteosynthesis, then they either plated everything with the Danis plate or they used intramedullary nails whenever possible. These clinics were the exception, but if they treated fractures operatively they used only one method.

**JS:** Maurice, you spent two and a half years with Dr Berger in Liestal doing mostly general surgery—abdominal and other soft-tissue procedures. How did you plan to proceed with your training?

**MEM:** When I took the job in Liestal in 1947, I told Dr Berger at the outset that I would stay only two years. I told him that I had made up my mind to be an orthopedic surgeon and that eventually I wanted to return to Balgrist to become chief resident and train in orthopedics. You must remember that because Berger was a pupil of Lorenz Böhler,<sup>1</sup> he was a strong believer in skin tight casts without any underlay. He knew this technique well and used it whenever possible. Therefore, it is fair to say that while I was at Liestal, I had no experience with operative treatment of fractures.

My first and foremost thought was to complete my studies in general surgery. My surgical experience in Ethiopia counted in Switzerland as part of my training and made it possible for me to start in Liestal right away as chief resident in general surgery. After I completed these two years, I met with Dr Berger and reminded him of my imminent departure. He asked if I could prolong my stay for two or three months, until he secured my replacement. I agreed. But it made no sense for me to stay any longer in Liestal. With my experience in Ethiopia and Liestal, I needed only one more year to be ready to acquire my certification in general surgery.

**JS:** Were you an exception or was general surgery a requirement for anyone who wanted to become an orthopedic surgeon?

**MEM:** When I began, it was certainly not a requirement. At that time, I was an exception among the orthopedic surgeons. After me, there were a few who had both degrees. They had to have some general surgical training, but not to the same degree. Orthopedic surgeons did only cold orthopedics. Fracture treatment was entirely in the hands of general surgeons. Generally, orthopedic surgeons did simple surgical procedures on bones or tendons and were not expected to do much more. You must remember that my experience in general surgery in Ethiopia, Liestal, and finally Fribourg led to my qualification as a consultant in general surgery. This put me in a good position to treat trauma as well. But there was no trauma at Balgrist. I received my diploma as general surgeon two years before I became an orthopedic surgeon.

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1 Lorenz Böhler (1885–1973) was one of the most prominent trauma surgeons in the early twentieth century. From 1925 to 1961, he was the medical director of the Unfallkrankenhaus (Accident Hospital) in Vienna, Austria, which was later named for him.

### Traveling fellowship: tour of European orthopedic centers

**MEM:** My plan was to return to Balgrist as chief resident. I knew that I would face competition for the job, since it was the most desirable place in Switzerland. I began to plan what I might do to become so well trained that Balgrist would find it very difficult to deny me the opportunity. In the 1950s, surgical training was not organized; each trainee had to do his best to organize his or her training opportunities. But what I had in mind was not what was generally done. Most trainees just accepted what they could get without trying to secure the best experience possible. I thought that before settling on applying to Balgrist to be chief resident, where I would complete my training, I should first visit as many of the major centers in Europe as possible. First, this would expose me to the most up-to-date techniques and second would allow me to evaluate where I wanted to train to become the best orthopedic surgeon. That was my goal.

**JS:** What did you decide to do?

**MEM:** When I left Liestal, I realized that to further my training I had to embark on a six-month traveling fellowship. I had to see what other famous surgeons were doing, learn all that I could about modern orthopedics, and find the ideal hospital in which to train. I had to finance this by myself, but I felt that it was a necessary investment for my future. As I mentioned previously, training in those days was not organized; a resident had to organize everything on his or her own to get the best training possible. Before I left for Ethiopia, Balgrist promised me that if I waited until the job of chief resident became available, I would have an excellent chance; but I wanted to become so well trained that they would have a difficult time refusing me.

I started out by visiting the important clinics in Germany. In Bad Tölz in the Bavarian Alps I spent time with Professor Lange<sup>1</sup> and his chief resident Dr Witt.<sup>2</sup> There I saw infections, reconstructive surgery to repair the damage of injuries from the Second World War, persistent malunions, nonunions, and a lot of chronic osteomyelitis. Later, Lange went to Munich and Witt to Berlin. I visited Professor Hohmann<sup>3</sup> in Munich and then, as I traveled north, I stopped in Cologne and Aachen. Unfortunately, Dr Pauwels was not in Aachen at the time, but I managed to visit him several times later. I also went to Paris and then crossed into Holland to visit Leiden where Van Nes<sup>4</sup> was chief. It was there that I knew, almost immediately, that I had found the place to stay and train. I was very impressed with the number and variety of cases that were being treated with unbelievable surgical techniques. Van Nes was the most skillful surgeon of those I had visited. I decided to stay there at least six months.

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1 Max Lange (1899–1975) became the professor and chairman of the department of orthopedic surgery at the Ludwig Maximilian University, Munich, Germany, from 1954 to 1968.

2 Alfred Nikolaus Witt (1914–1999) became chief of orthopedic surgery at the Free University of Berlin from 1954 to 1968, after which he followed his teacher Max Lange as director of the State Orthopaedic Clinic and the Orthopaedic clinic of the Ludwig Maximilian University in Munich. He retired in 1982.

3 Georg Hohmann (1880–1970) became professor and chairman of the Department of Orthopaedics at the Johann Wolfgang von Goethe University and director of the Friedrichsheim University Clinic in Frankfurt am Main in 1930. In 1946, he became the professor and chairman of the department in the University of Munich and its president from 1946 to 1954.

4 Cornelis Pieter Van Nes (1897–1972) was head of the Anna Clinic in Leiden from 1935 to 1952.

### Leiden and Van Nes

One had to see Van Nes operate to believe it. In the course of a day, he along with his chief resident and assistants were able to do about twenty cases, and among these there would be at least five major cases, such as arthrodesis of the hip or complex spine surgery. This was repeated each day of the week. Van Nes, who had trained in Boston with Smith-Petersen<sup>1</sup> and with Robert Judet<sup>2</sup> in Paris, practiced the most modern orthopedics of his day, done with the best operative technique I had ever seen. What also impressed me very much was the fact that he designed and made his own surgical instruments.

### Visit to Danis

It was Van Nes who told me that if I was interested in learning modern orthopedics and fracture surgery, I should visit Robert Danis in Belgium. I arrived on March 1, 1950. Danis was a general surgeon who worked in a general hospital, but he treated fracture cases at the private clinic where Lambotte<sup>3</sup> used to work. There he was completely alone; he had no assistants. When I wrote to him before my visit, he said he would prepare two cases for me to see. Unfortunately, they had to be cancelled. Danis was most apologetic but to make up, he showed me two other cases. One was a pseudarthrosis of both bones of the forearm, which he had treated only with his compression plates, which he called *coapteurs externes*. With these, he placed the pseudarthrosis under compression.

The second case was a fractured femur which had been treated with two *coapteurs* just two weeks before my visit. Danis said that he never used plaster of Paris in treating fractures. In his clinic, all fractures were treated operatively, and all patients were instructed to begin movement immediately. Rehabilitation was designed to bring about an immediate return of movement to the limbs and to the joints.

**JS:** How many trainees like you did fellowships? How many traveled to broaden their horizon?

**MEM:** Well, as far as I know, I was the only one.

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1 Marius Nygaard Smith-Petersen (1886–1953) was clinical professor of orthopedic surgery at Harvard Medical School from 1935–1946 and chief of the orthopedic service at Massachusetts General Hospital from 1929–1946.

2 Robert Judet (1909–1980) was chief at the Raymond Poincaré Hospital in Garches, France.

3 Albin Lambotte (1866–1955) was the chief of medicine at the Stuyvenberg Hospital in Antwerp after 1900.



**JS:** How did you decide whom to visit? Did you know these people from their publications?

**MEM:** Yes. Lange, for instance, was the editor of the German journal of orthopedic surgery. While I was with Van Nes I also had the opportunity to do two research projects. The first was a study about the prophylaxis of venous thrombosis after surgery. Do not forget this was in 1950! We used Marcumar or Tromexan.<sup>1</sup> We tried both these agents to find which was best. I published this work in Dutch with one of Van Nes' chief residents as the senior author. The resident translated the paper into Dutch and got his name in the byline. The second project was about hip arthroplasty. This study compared two methods: Robert Judet's and Smith-Petersen's. The object of the study was to define which method was best suited to the different types of complications in hip trauma. As one might expect, Van Nes did not do reposition osteotomies for pseudarthrosis of the neck, which I saw in Germany done by Pauwels, when I visited him later. The Judet arthroplasty was best suited for those cases where there was damage to the head or where the neck was defective in one way or another. This review of arthroplasties was helpful to me some years later when I turned my attention to arthroplasties of the hip.

My experience in Leiden was amazing. The number of complex cases and the speed with which they were treated was beyond anyone's imagination. Van Nes was a fantastic surgeon technically, but his residents were given little to do. It was similar to what I saw at the Mayo Clinic when I visited in 1959; the residents there did very little surgery. They assisted, or did the exposure, or closed the incision after the chief did the surgery. The boss did all the complex cases and left punctually at one o'clock in the afternoon. The residents then had to satisfy themselves with the few simple things that were left behind.

**JS:** You said that it was Van Nes who told you to visit Danis?

**MEM:** Yes. When I went to see Danis on March 1, 1950, I spent only one day with him. On March 2, I was back in Leiden.

**JS:** Had you ever heard of Danis before?

**MEM:** I may have, but I knew little about him and his work. I knew that he had written a book in 1949 and that some surgeons used his technique on rare occasions in treating fractures of the forearm. But prior to seeing him in person, I had known little about him, except for hearing that he had a system of lag screw fixation and compression plates. Danis never employed methods other than his own, but that was common in those days. Compression was the basis of his technique, achieved either with the lag screw or with his plates. Compression allowed for absolute stability, which he considered essential for an osteosynthesis to be successful and to achieve what he called primary healing of bone. That was healing of diaphyseal fractures without any radiologically visible callus. He called it *soudure autogène*.

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<sup>1</sup> Marcumar and Tromexan were anticoagulants.

**JS:** What did Danis show you that made such an immense impression?

**MEM:** The first patient he showed me had been treated two years earlier. Danis had made special arrangements for this patient to come so that I could see him with my own eyes. He had had a nonunion of the bones of his forearm. I saw something I had never seen before, the treatment of a pseudarthrosis without resection of the pseudarthrosis tissue, without opening the medullary canal, and without a bone graft. All that Danis did was to place the pseudarthrosis under compression with his plates. The pseudarthrosis then went on to heal, as if by magic. There was no callus. There was really nothing but sudden healing on x-ray. What was equally astounding was that the patient had no plaster fixation after surgery and that he started to move his forearm right after surgery without any restriction. The pseudarthrosis was healed, and the patient had almost a full range of motion.

The second case was a fresh fracture of the femoral shaft fixed with two plates. The patient was walking after about two weeks with the aid of a cane. I had never seen anything like it, except for the case of femoral nailing that I saw during my locum in Bern six years earlier. Danis did not have many cases. He was not exclusively a fracture surgeon. His documentation was primitive, like that of his predecessor Lambotte. He kept a list of the cases he had done and with each, he had sketches to show the problem and the treatment. Yet even these simplistic accounts were much more than most surgeons attempted. In those days evidence-based medicine was not even in its infancy. Most of the time, the information one could obtain was based on hearsay or relied on the opinions of surgeons who had a good reputation. Incidentally, this prevails to this day. You heard yesterday that Reinhold Ganz<sup>1</sup> would not allow a prospective documentation of his cases. Ganz feels that if you document everything it can be misleading.

**JS:** Just to clarify—in the early days, AO also used two plates on the femur, but the results were poor.

**MEM:** Yes, that is true, but not when I used two plates. My cases did well. You are referring to cases that were done by Hardi Weber,<sup>2</sup> when he was a young surgeon, and those of Mumenthaler.<sup>3</sup> I performed some cases with two plates. If you do them carefully and atraumatically, preserving the blood supply in such a way that you use the minimum number of screws, and stagger the two plates, you will succeed. I agree, of course, that the best method is an intramedullary nail.

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- 1 Reinhold Ganz (b. 1939) became medical director of the Clinic for Orthopedic Surgery at the University of Bern and was professor and chairman of the department of orthopedics from 1981 to 2004.
  - 2 Bernhard G Weber (1927–2002) was chief of the orthopedic clinic in the hospital of St Gallen after 1967.
  - 3 Andrea Mumenthaler (1927–2000) was chief of the orthopedic and trauma department of the District Hospital in Langenthal in Canton Bern from 1967 to 1982.

*[This is an excellent example of Maurice's belief that he could make anything work, and that what he designed could not be improved. His own experience often clouded his objectivity. His method, which he practiced from the day he wrote down his principles in Fribourg, was based on the achievement of absolute stability with osteosynthesis in every fracture. It took twenty years, from 1958–1978, for people to realize that there was a place for relative stability and later for minimally invasive surgery, which demanded x-ray control. Maurice, however, could not deviate from what he had designed, which had worked well for him and many others. He was not able to accept changes to his concept of absolute stability, such as the bridge plate. For example, Enrique Quiapo de Llano from Malaga, Spain bemoaned the fact that whenever he tried to discuss the more recent advances in relative stabilization, which he was using clinically, Maurice would simply cut him off and say that that was not how to do things.]*

**JS:** What was going through your mind at the time that you were with Danis seeing these novelties?

**MEM:** I realized that I was witnessing a method of osteosynthesis which allowed one to operate without having to resort to plaster as supplemental fixation. From my point of view, this was the most important observation. I had never seen this before and had never understood that this was possible. I was convinced, however, that many of the complications of fractures, like terrible stiffness, were the result of immobilization. The second revelation for me was the healing of a pseudarthrosis under compression without resection of the pseudarthrosis tissue and without bone grafting.

**JS:** How old was Danis when you visited him?

**MEM:** I don't know exactly, but he was surely more than sixty.

**JS:** How long had he been working with his method?

**MEM:** He told me that he started with these concepts and methods in 1926. I was meeting with him about twenty-five years later.

In 1928, Danis published his first article on his method. He was a follower of Lambotte and worked in the same clinic, but he worked completely alone. His ideas developed as an extension of Lambotte's ideas. It was a private clinic which dealt with a small number of specialized cases, and because Danis was a general surgeon, fracture treatment was only a part of his activity. Like Van Nes, he also believed that a good surgeon had to make his own instruments. That did not necessarily mean he had to have metallurgical skills, but he had to be able to design them. Danis designed his own screwdriver, screws, and plates. They were made for him by Gembloux, a large instrument factory. His instruments were used in France but never in Germany. A few surgeons in Switzerland had used his plates. Robert Schneider,<sup>1</sup> my good friend, did have access to Danis' instruments. He had been to a course in Lyon and heard Danis lecture. Once, sometime later, I saw him use the Danis plate in treating a forearm fracture. In 1952, when I was in the military service, where I had the opportunity to discuss fracture treatment with colleagues, Schneider asked me whether I knew about Danis. That was probably the first serious discussion I had with Robert Schneider about fracture treatment. It was then that I told him about my visit to Danis and my ideas which had evolved because of that visit.

### Return to Switzerland

**JS:** Maurice, would it be correct to say that the visit to Danis inspired you to have a completely new concept of fracture treatment?

**MEM:** Well not exactly. That came somewhat later. As you know, my dream when I was leaving Liestal was to apply to Balgrist for the position of senior resident. I had discussed this possibility in 1946 with Nievergelt before leaving for Ethiopia. Nievergelt, who was chief resident at that time, told me then that he would stay up to four years, depending on whether Professor Scherb would allow him to study to be a privatdozent. That is why I undertook all the travels, the fellowship in Leiden, and the job in Liestal. I was, to some degree, filling time. Now that I was back from Holland, I reapplied in 1950, only to be told that Professor Scherb had just retired and Professor Francillon<sup>2</sup> had been appointed as his successor. Francillon had been a chief resident of Professor Scherb in the past, but when he saw that his road had been blocked because Scherb was not ready to retire, he went into private practice in Zürich to await a future opportunity. When Professor Francillon took over, he found out that prior to retirement, Professor Scherb had promised the position of chief resident to another surgeon. The government authorities insisted that this promise be kept. This meant that once again my road was blocked for at least another two years. I had to find things to fill them.

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<sup>1</sup> Robert Schneider (1912–1990) was chief surgeon of the Grosshöchstetten Hospital in Canton Bern from 1956 to 1970, after which he worked in his private practice in Biel.

<sup>2</sup> Max René Francillon (1899–1983) was director of Balgrist Orthopaedic University Clinic in Zürich from 1950 to 1969.

When I was looking for a job as a chief resident, I applied to the Children's Hospital in Zürich where Professor Grob<sup>1</sup> was chief. I wanted to work with him and I was one of final two applicants to be considered. I was interested in the job because it involved heart surgery. I had been impressed with heart surgery when I was in Leiden with Van Nes, where I became acquainted with the leading heart surgeon in Holland, who had been trained in the United States. He worked in Leiden at the time. I came to know him because of the paper I wrote on postoperative thrombotic prophylaxis. In the end Grob took another candidate from Lausanne, who had worked under Decker at the university clinic. Once I left Balgrist in 1957, Grob asked me to look after the orthopedic problems at his hospital.

I discovered in late 1950 that Balgrist was blocked once again. What was I to do? My first decision was to apply to military school and take courses that would lead to the rank of lieutenant. I was given my own military unit, a medical ambulance unit. After military school, I had to complete my practical service. While I was doing this, I looked around to find what I could do next. I saw an advertisement for a post of chief resident in general surgery in Fribourg. I applied. I was well qualified for the position, but I soon discovered that once again I had unbelievable luck. For some reason, the man who had already been promised the position was not able to come and they were now offering the position to me.

### Fribourg

**MEM:** The Bürgerspital in Fribourg was the general hospital of the Canton of Fribourg. I had committed myself to stay one year, but as it turned out I stayed a bit longer. The chief was Dr Grec,<sup>2</sup> a Swiss who had been a pupil of Decker, the very famous Swiss surgeon from Lausanne who treated fractures. Decker was a staunchly conservative surgeon; he treated all fractures with traction and plaster immobilization. When Dr Grec found out that I was interested in fracture treatment, he put me in charge of fracture care, since he himself had little experience in this field and had other interests. This appointment gave me an unbelievable opportunity. I had now a free hand to treat fractures my way. After my visit to Danis, I kept thinking about operative treatment of fractures and began slowly to evolve in my mind a concept of fracture treatment which depended on stable osteosynthesis without the use of plaster immobilization and with immediate mobilization of the extremity.

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- 1 Max Grob (1901–1976) was the first Swiss surgeon to devote himself to surgery for children. He was chief of the surgical clinic at the Children's Hospital in Zürich from 1939 to 1971.
  - 2 Vincent Grec became the chief surgeon at the Bürgerspital in Fribourg in 1948.

Once I started in my job, I made some interesting observations within a short period. Fribourg had five hospitals, which took their turn in fracture treatment. About five or six months after I started, something interesting began to happen. The police usually directed where trauma was to be taken, since they kept track of which hospital's turn it was to receive trauma cases. But suddenly, all the trauma cases started to come to us. Almost overnight the other hospitals had no trauma. All patients wanted to come to us. Fribourg was not that big, and word had spread quickly. From the start, I decided to treat all closed fractures of the tibia either with lag screws or lag screws and plates. I had the necessary equipment to put my new system of fracture treatment into practice. The hospital was good to me. Dr Grec had given me a free hand and I was able to order a full complement of Danis' screws and plates (coapteurs) from Gembloux, the factory that made all the Danis' implants.

My treatment consisted of absolutely stable fixation and immediate mobilization. Once the patients regained a full range of motion and once all the swelling was gone from the leg, only then would we put them in an above-knee cast. They were not allowed to bear weight and were instructed to use crutches. After four weeks, they were readmitted to hospital overnight. The long leg-cast and stitches were removed. The leg was x-rayed, and if all was well and the leg joints moved freely, it was put into a below-knee walking cast and sent home.

**JS:** Maurice, in 1950 the screws and plates were still quite primitive. Were you convinced that what Danis used was superior?

**MEM:** Oh yes! When I was visiting him, I could see immediately that his equipment was superior. I took one of his plates and some screws, as well as the name of the factory, with me. Once I got to Fribourg I ordered all that I needed.

**JS:** How long did you stay in Fribourg?

**MEM:** All in all, I stayed there fourteen months.

**JS:** How many tibial fractures did you treat during this period?

**MEM:** I treated seventy-five tibial fractures. I followed them carefully and documented every case. Seventy-two were excellent and three were failures. The three failures were not failures of the method but of my mistakes. Now you must realize that I stayed there just over one year, and did not have that long a follow up, but I did my best.

**JS:** Were you treating these cases exactly as Danis did?

**MEM:** No. No. The visit to Danis was unquestionably a turning point in my thinking, but I could see immediately that there were some things that could be done better. I began immediately to think of how to improve things. Nevertheless, stable osteosynthesis, as I had seen at Danis' hospital, would become the underlying principle.



*[This was very typical of Maurice. When he saw something that he had never seen before, he took the time to become fully familiar with what he was seeing, but then immediately asked himself what could be done better.]*

**MEM:** The most important element was to achieve absolutely stable fixation. That was the key in making the extremity pain free. I heard this from the patients I saw during my locum in Bern and from the patients I saw at Danis'. Freedom from pain after surgery was important for the achievement of movement. The second element was immediate mobilization of the extremity to regain a full range of motion of the neighboring joints. Once a patient regained a full range of motion, he would preserve it even if he spent some time in a cast after that. I also turned my attention to the current literature, which I followed carefully. I got hold of John Charnley's book *The Closed Treatment of Common Fractures*.

### Maurice modifies and improves Charnley's compression clamps

**JS:** But Maurice, this book deals mostly with closed, very conservative treatment of fractures.

**MEM:** Yes, that is true, but for me there were two very important things in the book. The first was the principle of cancellous bone healing under compression. This was definitely the first observation ever made that there was a difference in healing between cancellous and cortical bone. Charnley described it carefully and showed how it was achieved using his external compression clamps and flat surfaces of cancellous bone. The second is something the AO has failed to appreciate to this day: that is, the difference between fractures of long, tubular, cortical bone and fractures through mainly cancellous bone of the metaphysis. Charnley was the first to emphasize the different healing of cortical bone, which heals by the formation of callus, and the healing of cancellous bone, which heals by means of contact. This was a major, conceptual step forward. As soon as I got to Balgrist I designed my external compression clamps with threaded bars [*an improvement over Charnley's*] and introduced the Charnley method of joint arthrodesis, particularly in securing the healing of knee and ankle arthrodesis, but with the use of my compression clamps. My external compression clamps had major advantages compared to Charnley's. My clamps could be used to distract and compress and were more stable. Furthermore, I was the first to show that two of these clamps, when combined on one side in treating an intertrochanteric osteotomy, could be made to achieve compression also on the medial side. You see, if you use only one clamp on the lateral side to compress the two Schantz screws, the medial side gapes open. If you use two clamps and distract the one further away from the bone and compress with the one close to the bone, you can achieve compression of the whole cancellous surface and get rapid contact healing of the osteotomy. I designed this in 1952 when I came to Balgrist as chief resident. You see, Charnley used external clamps only for compression. Judet also had an external clamp which he used for compression. I was the first to design a clamp which could also be used to distract, and this made it possible to bring the medial side under compression. This was one of my first original contributions.

**JS:** Maurice, you made a strong point of the importance of a surgeon designing his own instruments and implants. You were impressed with Van Nes who designed his own instruments and as well with Danis. If you recall the days in Fribourg, did you design anything else at that time?

**MEM:** The first instrument I designed was a modified screwdriver. I could never understand why people made the handle round. One could never transfer the power properly because of the difficulty of getting a firm grip. The first thing I designed was a new grip, which had a more or less quadrilateral cross-section. A new screwdriver was also the first instrument I designed for the AO. The next modification was the screw head. We had screws with a cross, a Philips head, which I modified to a hexagonal recess. This was my first project when I began to work together with Robert Mathys<sup>1</sup> in April 1958.

While I was at Balgrist as chief resident, I was concentrating mostly on hip surgery. I designed the compression clamps and a modified way of using them. I designed many aiming devices to make hip surgery more accurate. I was very much impressed with the rapid healing of cancellous bone under compression. This was most important in rapid healing of intertrochanteric osteotomies, which I began to do when I returned to Balgrist as chief resident.

#### Balgrist Clinic 1952–1957

**JS:** Maurice, when did you begin at Balgrist for the second time?

**MEM:** I started as an assistant in the fall of 1951 and in early 1952, I became chief resident. Because Balgrist dealt only with elective orthopedic surgery, I had to put fracture treatment to rest for a while. I almost had to forget it. But now that I was forced to concentrate on orthopedics, I began to think how I could use my newly developed principles of orthopedic surgery. I am an extremely organized person who always makes far-reaching plans. I realized that nothing happens in life just by chance, although luck can help. In 1952, I had already made the decision that I would make my mark as an expert in the diseases of the proximal femur and that I would concentrate all my efforts to demonstrate the advantages of my concepts of stable osteosynthesis.

*[This is a very important insight. This is the pattern of behavior Maurice followed all his life. Things seemed to happen just by chance, but Maurice had planned everything well in advance.]*

Once I got to Balgrist, I continued to make new instruments. Early on, I focused on hip surgery, since I would have to concentrate on this area for my PD (privat-dozent) thesis. Since the implants for osteosynthesis available at the time were not ideal, I began to study them to see how they could be improved. I started out with a presentation of papers and illustrations.

“*The first instrument I designed was a modified screwdriver. I could never understand why people made the handle round.*” MEM

“*A new screwdriver was also the first instrument I designed for the AO.*” MEM

<sup>1</sup> Robert Mathys (1921–2000) opened a factory in Bettlach, Solothurn in 1946 for the producing of screws and instruments.

**JS:** How well received were your ideas about making instruments?

**MEM:** Well, no one really understood the need for special instruments and implants. It was when operative fracture treatment began to be accepted that my colleagues and other surgeons recognized that special instruments and implants made the application and actual realization of the principles much easier. Instrument and implants did not replace principles, but they made it easier to apply the principles.

I had five exceptional years as chief resident at Balgrist. I was the right-hand man of Professor Francillon, who had come to depend on me for almost everything. I ran the clinic in an exemplary manner. I developed many new surgical procedures. By the time I left Balgrist in 1957, I had transformed it into the most modern orthopedic unit in Switzerland.

*[This is typical of how Maurice saw his role. In the 1940s Balgrist was a large, famous, orthopedic hospital that had been looked upon for decades as a long-term hospital where crippled children stayed for months, sometimes years. Its surgical orthopedic procedures were simple, unlike the general surgical departments where modern techniques developed. When Maurice arrived at the end of 1951 as a junior assistant for the second time, soon to become chief resident in early 1952, Balgrist was undergoing a momentous change. The polio vaccine had appeared. Overnight the patient load began to change. Now instead of crippled children, the hospital was flooded with adult patients with degenerative arthritis. Maurice addressed these with his newly developed surgical hip procedures, like osteotomies and other innovative operations of his design for the hip. He also provided modern care for the rest of the musculoskeletal system and managed, with his surgical virtuosity, to transform the hospital into a modern orthopedic clinic. For Maurice, it was undoubtedly "the most modern." When it came to his surgical achievements, modesty was not one of his attributes.]*

**MEM:** My fame spread locally and throughout the country. Many patients wanted to be admitted to Balgrist to have me as their doctor. It even went so far that some of the professor's private patients inquired when the professor would be away, so that they would be admitted to hospital during that interval, so that I could do their surgery. I was also busy during my free time, when I did surgery outside of Balgrist in the hospitals of my circle of surgical friends. With an eye on my future research to become a privatdozent, I collected many hip cases, which I documented meticulously as part of my thesis on the "osteotomies of the proximal femur." It dealt with orthopedic problems and posttraumatic complications. I described in detail procedures like an osteotomy designed to treat nonunion of the femoral neck following fracture. My thesis was accepted by the medical faculty. When it was published in 1957, the book, *The Osteotomies of the Proximal Femur*, won the Heine prize of the German Orthopaedic Association. This brought academic recognition and fame. Professor Francillon told me that the faculty was united in wanting to grant me the title of privatdozent at the end of June 1957.

**JS:** Maurice, what made you consider leaving Balgrist? As you said, Professor Francillon, who had other interests, left the day-to-day running of the clinic entirely in your hands. You made it a modern orthopedic hospital. Why did you decide to leave in 1957?

**MEM:** In 1957, I was married with three children, but I was earning only 1,800 francs a month. My family was financially strapped. To afford a holiday, I had to do outside assessments for extra cash. To find a way out of this situation, I had attempted to get a private bed at Balgrist that would allow me to earn a little extra from a few private patients. In May 1957, I met with Professor Francillon and explained my financial situation and that I would be forced to leave in three months unless I was given an opportunity to earn more. Professor Francillon discussed my ultimatum with the governing committee, but they voted against giving me a private bed. The committee would not budge from this decision, nor would Professor Francillon. I told him that I was not eager to leave but had no alternative unless I was given better opportunities to increase my income. Professor Francillon was vehemently opposed to my leaving. He went so far as to threaten me. He even tried to reverse the decision of the committee and have my PD revoked. He said that if I were to apply to St Gallen as chief of the new orthopedic clinic, which was to open in 1960, he would personally intervene to make sure that I would not be accepted, but if I stayed at Balgrist, the appointment would be mine in three years. I assured him that Norbert Gschwend,<sup>1</sup> who was an assistant at Balgrist at the time and had been well trained by me, would make a superb chief resident. But Professor Francillon would not be swayed. He said that he had to listen to the university committee. I was equally determined that I could not afford to stay.

The issue of my being awarded my privatdozent dragged on for over a year. It was reviewed by the granting committee in discussions which I could not attend. Finally, in 1958, the committee decided that the PD would not be withdrawn. In this struggle, I was helped by Fanconi,<sup>2</sup> who worked at the Children's Hospital in Zürich. Fanconi is credited with the creation of pediatrics as a separate specialty. He was a towering figure and his support meant a lot to me.

#### 1957–1960: private practice at the Hirslanden clinic in Zürich

**MEM:** On October 15, 1957, I left Balgrist. Since I had given notice in June, when I first spoke with Professor Francillon, I felt free of any obligation to my professor and the institution. In the summer of 1957, I had already done some private surgery at the Hirslanden, a private orthopedic clinic in Zürich. When I left Balgrist, I had already booked two cases for the following Monday at the Hirslanden clinic. Before my first day of surgery ended, I found that my entire week was booked. The word was out that I was now in private practice at the Hirslanden clinic and patients were beginning to line up. Before long, I had a booming private practice. I was operating not only at the Hirslanden but also at four university clinics: Interlaken, Bern, Basel, and the children's hospital in Zürich. In addition, not long afterward, I was operating in sixteen canton hospitals, as an itinerant surgeon with all my tools in the back of my car. I was operating all over Switzerland and abroad, in Holland and Germany, but particularly in Italy, where I had rapidly become very famous.

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1 Norbert Gschwend (b. 1925) became chief of the Wilhelm Schulthess Clinic in Zürich in 1962.

2 Guido Fanconi (1892–1979) was head of the Children's Hospital in Zürich and professor and chairman of pediatrics from 1929 to 1965.

**JS:** Now Maurice, we know that by 1959 you had a diploma as a consultant in general surgery and orthopedic surgery. When it came to surgery at the various hospitals, did you need to have a special permission from each?

**MEM:** No, not at all. It was all up to the chief of surgery. If he invited me and assumed responsibility, I could perform any surgery I wanted on the patients who were there. If anything were to go wrong, the surgeon who had invited me would be responsible, and I, of course, would be thrown out of the hospital.

During the three years between 1957 when I left Balgrist and 1960 when I took over the clinic of St Gallen, I traveled widely and operated in many places. During my trip to the United States in 1959, I operated in North America in many centers. I came as the guest of Walter Blount<sup>1</sup> of Milwaukee at the meeting of the American Orthopaedic Association (AOA) in Lake Placid. This was the most prestigious American orthopedic meeting held each year, a gathering of the most senior academic surgeons. I knew Blount from the time I had visited Pauwels after 1957. Once in the United States, I visited many other orthopedic centers and performed surgery to demonstrate my techniques. Besides my flourishing practice in Italy, I did surgery in Germany with Pauwels, also near Rotterdam in Holland, and in France. One time, I performed one operation in Germany and then another over the border in Holland. I also traveled to Turkey to operate. I had become very famous well before I had my appointment at St Gallen in 1960.

But despite all of this rapidly exploding fame, I still had no definite position, except for the Hirslanden private clinic in Zürich. At this clinic, foreigners who came as patients would pay around 3,000 francs. The unofficial chief of this hospital, Dr Preis was my good friend. He was getting on in years but still controlled one third of the beds at Hirslanden. In 1957 he told me that I could have as many beds as I needed. He even offered me some shares in the clinic; I still have them after all these years. He was happy to give me beds since I filled them rapidly. In 1957, Dr Preis was about seventy years old and ready to retire. He was prepared to suggest that his beds should be made available to me, since I was certain to fill them rapidly. I also had patients in another new private clinic, which had been built not far from where I lived on the outskirts of Zürich. I was extremely busy and was developing a tremendous surgical practice and a reputation. Private clinics in other parts of Switzerland wanted me to come and operate as well. In Canton Zürich alone, I did surgeries in eight private clinics.

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<sup>1</sup> Walter Putnam Blount (1900–1992) was chief of the Milwaukee Children's Hospital and in 1957, professor and chairman of the department of orthopedic surgery at the Marquette University School of Medicine.

The first patient I had at the Hirslanden lived in Zürich. She was a patient of Dr Preis, but he asked me to perform her surgery. I asked if a fee of 3,000 francs would be too much? Dr Preis said that I could charge much more, since he usually charged 10,000 francs. Because she needed an arthrodesis of her ankle, this was a golden opportunity for me to use my new external compressors with the threaded bars, which I had designed in 1952. Everyone was in awe when the arthrodesis was solid in four weeks. Usually it took at least three months in a cast. No one had seen nor heard of anything like this. This really fueled my fame in the community. Fortunately, all the cases I performed went extremely well and my practice kept growing. The clinic was also happy because I brought many patients. It was becoming clear to me very quickly that if I were to concentrate on private patients, I could be wealthy in a short time. However, many of the cases which I did all over Switzerland paid little, if at all. They were the public patients of the surgeons for whom I was doing the surgery and who received the greater part of the fee. The fees I earned from my private patients allowed me to do this work. However, as long as I earned enough to support my family, I was not concerned.

### An itinerant practice of surgery

**JS:** Maurice, during the five years you spent at Balgrist from 1952 to 1957, you began to operate in hospitals of other surgeons in your free time, such as on Saturdays. These were also the years when you began to formulate your vision of a group of surgeons who would work together with you to establish a new school of fracture treatment. How did all this come about?

**MEM:** When I started at Balgrist in 1952, I delivered two important lectures. One was held in Winterthur and the other at Balgrist. I invited many surgeons to the lecture at Balgrist because I wanted to share with them what I had learned while treating fractures. I had made some important observations.

I showed and talked about the things I saw when I visited Danis. I showed his book and talked about my own observations while applying these new principles to fracture treatment. This inspired some surgeons to visit Danis. Most of them came back having seen nothing, or at least without noticing new ideas or things. Some were inspired by the new things they saw at Danis' clinic, and one of them, Leemann who was the chief resident in Winterthur, even developed a new cerclage.<sup>1</sup> He thought that one could secure compression with a cerclage using two wires. The problem with this method was that compression could not be maintained; it was lost when one fixed the two wires together. The fixation was never sufficiently stable to allow free movement, and it always had to be combined with a plaster cast. Despite the cast, many went on to develop a nonunion. Nevertheless, his cerclage made a lot of money for Leemann. I was astounded that the other surgeons from Winterthur who visited Danis came back empty-handed. They saw nothing, no new possibilities, and they never used the principles of Danis in their treatment of patients. Leemann was the only one who was sufficiently impressed with the concept of compression to put it into practice, but he shied away from plates as too invasive. His attempt to secure compression with cerclage, which failed for technical reasons, was soon forgotten.

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<sup>1</sup> Leemann RA. Die Falz-Cerclage und der Falzspanner. *Helvetica Chirurgica Acta*. 1952;19:119. German.



I was similarly surprised when many chief residents attended my lecture at Balgrist. Among them was H-U Buff,<sup>1</sup> who was chief resident in general surgery at the university hospital in Zürich. I showed them fantastic cases, which I had treated with my new concept of absolute stability with compression and early motion, but I failed to make any headway. They remained totally unimpressed. This behavior allowed me to make two extremely important observations which had a profound impact on my life. I began to realize that to have any credibility and impact on the behavior of others, one had to have an academic degree, at least a privatdozent (PD). An academic degree gave one authority and credibility.

The second observation was even more important. When I visited Danis, I saw that he was alone, that he had no supporters, and was not able to do any research since he had to fund everything out of his own pocket. I realized that one first had to have a team and second, one had to have funding. I needed a group of chief residents or practicing surgeons who were treating trauma. No university orthopedic department in Switzerland treated trauma. Trauma treatment was done by general surgeons, most of whom practiced outside the university. These observations inspired me to work hard toward a PD. I did not aspire to become a professor, but I wanted, at the very least, to become chief of a department of surgery. At Balgrist I was the sole chief resident for a 150-bed hospital, which dealt only with cold orthopedics, but this was not enough to give me credibility. I needed to distinguish myself as a surgeon. I needed a reputation and I needed to collect material for my thesis to get a PD. It was an extremely busy time of my life.

*[This proved to be one of Maurice's most critical observations. Instead of turning to the general surgeons in the teaching hospitals, he realized that even if the chief residents might agree with his ideas, they would still have to convince the professor. He also observed that most fractures, except the most complex, were treated by general surgeons, who practiced outside of the university in small district hospitals scattered throughout Switzerland. These district hospitals had been introduced in Switzerland before the Second World War and were designed to improve patient care. Each had a chief surgeon and a chief internist. Some of them also had assistants, depending on the size of the institution. These chiefs were fiercely independent and were often hostile to academic surgeons, since many had had their career paths blocked in one way or another by them. They became very important for Maurice when he looked for surgeons who would be ready to join him in his quest to form a new school of surgery, which would be radical and would inevitably be opposed by academic surgeons.]*

“ When I visited Danis, I saw that he was alone, that he had no supporters, and was not able to do any research since he had to fund everything out of his own pocket. I realized that one first had to have a team and second, one had to have funding. ” MEM

<sup>1</sup> Hans-Ulrich Buff (1913–2004) became professor and chairman of the department of general surgery and director of the new university surgical clinic B at the University of Zürich from 1961 to 1985.

### Meeting with Robert Schneider: 1952

**JS:** Maurice, tell us about your meeting with your old school friend and rowing companion Robert Schneider.

**MEM:** During my military service in 1952, I reconnected with Robert Schneider (**Fig 13**). I was six years his junior. We had known each other at school in Biel, since both of us were on the rowing team. I was always the coxswain, since I was small and light. Schneider was tall and strong. He was the leader; we gave him the nickname *Spitz* (from the German *Spitze*, meaning “tip” or “summit”). He was always the one out in front. When rowing, he may have been in the bow, but in a boat the coxswain had the leading role, since he is the only one who can see where the boat is going and plan the tactic to win.

*[This was very typical of Maurice. When he was a youngster and part of a gang of boys, he was the leader, despite being the youngest and smallest. When he joined the fraternity at university, it did not take long for him to be voted as the one to carry the colors of the fraternity and be in charge of the young fraternity brothers. When he was rowing, he was the strategist. When he met Schneider, the game of “who is the leader” would play itself once again.]*

**JS:** As a chief resident at Balgrist, did you have to do military service?

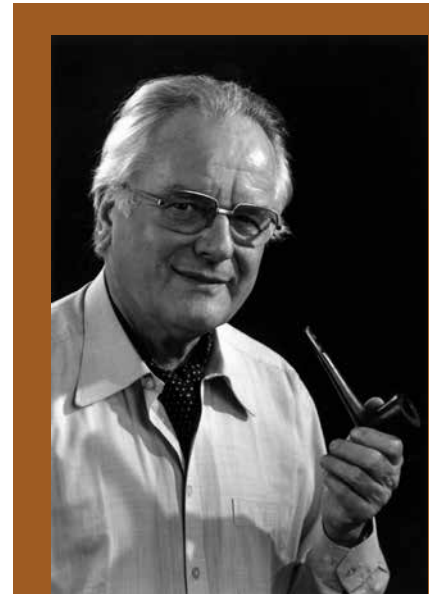
**MEM:** Yes. It did not matter what you did. Every Swiss doctor had to do military service, except those who were heads of their clinics, since in case of war they would be required to be at home to run the clinic, which would automatically become a military installation.

**JS:** How long was your military service?

**MEM:** On average, we spent about three weeks a year doing military service.

**JS:** You said once that during your obligatory military service while you were at Balgrist, you ran into Robert Schneider, whom you already knew, and that this meeting was one of the most important events in your life. Can you explain?

**MEM:** In 1952, while I was at Balgrist, I served in the military for my regular three weeks. It was then that I reconnected with Schneider. At that time, he was chief surgeon of the hospital in Grosshöchstetten. Schneider was a very important general surgeon, well known and respected in Switzerland. When he finished his training in general surgery, he was destined to become chief of an academic unit in Bern, but he was too young. Instead Dr Lenggenhager was appointed as chief surgeon of the university hospital in Bern.<sup>1</sup> In 1940, this blocked Schneider’s chances for an academic career. Soon after he began to work as a general surgeon in Grosshöchstetten, a small district hospital not far from Bern; in 1950 he took over as surgeon-in-chief of the same hospital. It was a far cry from an academic career, but he was active in our professional association and committees and was well respected.



**Fig 13** Robert Schneider, Maurice’s best friend in the AO.

<sup>1</sup> Karl Lenggenhager (1903–1989) was professor and chairman of the department of surgery at the University of Bern from 1942–1971.

During his military service, Schneider served in the infantry; he had nothing to do with the medical units. He held the rank of lieutenant and was about to advance to the rank of major, but now his future in the military was blocked because of his position as chief surgeon of his hospital. He was also the commander of a unit, as I was, but when he became chief surgeon, he could no longer command a unit nor advance further in the military. Thus, when he was due to serve in the army in 1952, instead of leading his own unit as major he now had to serve in my medical unit. He had an important position since he was the chief surgeon of our military hospital, while I was the commanding officer. I had four men in my unit; all were lieutenants and chiefs of medical units in their own hospitals. Their rank as chiefs of their hospitals did not excuse them from service, but they could not hold a leadership position in the army.

**JS:** You told me that you once treated a patient for Schneider and that he was so impressed that he was ready to listen to your radical ideas.

**MEM:** Yes, that is true. When I met Schneider, I took the opportunity, whenever possible, to discuss my ideas of fracture treatment at great length. He was unimpressed. Then one day, as if to keep me quiet, he said:

“You know, I am a close friend of the head of our medical fraternity. His sister had a bad accident and broke her shoulder. She had a four-part fracture of the proximal humerus. The surgeon who treated her excised the fractured head since he did not know what else to do. She now has a very painful pseudarthrosis. A shoulder arthrodesis would be the best way to treat her, but unfortunately, she is a short, obese woman who weights 120 kg. She would not survive a week in a shoulder spica cast, never mind a few months.”

In those days, the only way to obtain an arthrodesis of the shoulder was to immobilize the fragments for at least four months in a shoulder spica cast.

Then Schneider said to me, “If everything you have been telling me is true, then you should be able to help her. If you can secure an arthrodesis without putting her in a shoulder spica, then I will believe all your tales about the new form of osteosynthesis that you have been talking about.”

Like most general surgeons in Switzerland, Schneider thought that an orthopedic surgeon knew little about actual surgery, since they did not treat fresh trauma and most avoided treating fracture complications. Remember, I was at Balgrist which, when I started, was still known as the hospital for crippled children. It was seen as a long-term institution rather than a hospital. By the time I left, I had transformed it into the most modern orthopedic clinic in Switzerland.

“ Then Schneider said to me, ‘If everything you have been telling me is true, then you should be able to help her. If you can secure an arthrodesis without putting her in a shoulder spica, then I will believe all your tales about the new form of osteosynthesis that you have been talking about.’ ” MEM

**JS:** Were you able to help the sister of Schneider's friend?

**MEM:** I did. I made a plaster cast, but not a spica. Her arm needed support. I made a cast that went around her waist and rested in the vicinity of her iliac crests. I say vicinity because the crests were not palpable. On this waist band, I erected a buttress for her arm out of plaster. She wore this for a few days and assured me that she would be able to tolerate it for a longer period. With this assurance, I went ahead with the surgery. I used my external compression clamps to compress the shaft fragment against the prepared glenoid fossa and I supplemented the fixation with a wire "tension band" between the acromion and the shaft. All went well, and within two months she had a solid arthrodesis, which was painless, and her extremity was in a functional position.

#### Meetings with other surgeons in the cantonal hospitals

**MEM:** Schneider was immensely grateful and impressed. He was so impressed that he began to introduce me to his close friends as "the surgical star." These friends were also chiefs in their own hospitals scattered throughout Canton Bern. The first one I met was Walter Bandi<sup>1</sup> (**Fig 14**) who was the surgeon-in-chief of Interlaken. He was six years my senior. He and Schneider had studied together and were close friends. Bandi and Willenegger were also close friends; they had studied together in Bern. The second one I met was Walter Schär,<sup>2</sup> a general surgeon from Langnau. He played an important role when we began to organize our group.

- 1 Walter Bandi (1912–1997) was chief of surgery in the Regional Hospital of Interlaken.
- 2 Walter Schär (1906–1982) was chief of surgery in the District Hospital in Langnau from 1944 to 1968.



**Fig 14** Robert Schneider and Walter Bandi, two founding members of AO.

**JS:** You then had the opportunity to operate at their request at Interlaken and in Langnau. Did you operate on fracture cases for them or were they cold orthopedic cases?

**MEM:** They were all orthopedic cases. But this was not important. Being able to operate with them gave me the opportunity of demonstrating the principles of stable osteosynthesis as applied to cold orthopedics. It also allowed me to show them, repeatedly, the advantages of stability achieved with compression. I was also able to teach them atraumatic approaches and the importance of maintaining the blood supply to bone. Bit by bit they understood that only living bone heals rapidly. Dead bone must revascularize before it can heal. This, of course, lengthens the time that an internal fixation has to last before it breaks or loosens. The longer the healing time, the greater the risk of failure. These were the important principles of surgery that I stressed.

These surgeons invited me to come to their hospitals to help with difficult cases. At first, I was not able to get away very often—in the first year no more than a couple of times. Later, weekend visits of surgery, discussions, and teaching became more frequent. I used these occasions to share my surgical philosophy with my colleagues, my ideas about stable osteosynthesis, and my surgical techniques. All along I thought about the need to develop a circle of devoted, enthusiastic followers, who would be willing to work together to establish a new school of operative fracture care. This was my ultimate dream. I kept thinking of Danis, who was so much ahead of his time with his concepts of stable osteosynthesis, and yet was not able to accomplish much because he worked alone. Danis' failure to be influential sparked in me the realization that I would succeed in establishing a new school of surgery only if I were able to surround myself with an enthusiastic and devoted team.

**JS:** Robert Schneider also introduced you to Hans Willenegger who was chief surgeon in Liestal, where you had been for two years until 1950. You also said that subsequently he introduced you to Walter Stähli from Courtelary.

**MEM:** In 1955, Willenegger<sup>1</sup> joined our group. He had had been the chief resident of Professor Nissen<sup>2</sup> before Martin Allgöwer,<sup>3</sup> and had taken Dr Berger's position in Liestal when he retired. At this point Willenegger was the most experienced trauma surgeon in the group; he had also done research.

“ I was also able to teach them atraumatic approaches and the importance of maintaining the blood supply to bone. Bit by bit they understood that only living bone heals rapidly. Dead bone must revascularize before it can heal. ” MEM

“ All along I thought about the need to develop a circle of devoted, enthusiastic followers, who would be willing to work together to establish a new school of operative fracture care. This was my ultimate dream. ” MEM

1 Hans Robert Willenegger (1910–1998) was the chief surgeon at the Canton Hospital of Liestal from 1953 to 1975 and professor extraordinarius of the University of Basel after 1958.

2 Rudolph Nissen (1896–1981) was professor and chairman of the department of surgery at the University of Basel, Switzerland from 1952 to 1967.

3 Martin Allgöwer (1917–2007) became chief of surgery of the Canton Hospital in Chur, Switzerland in 1956. In 1967, he was appointed professor and chairman of the department of surgery at the University of Basel.

**JS:** You also said that subsequently he introduced you to Walter Stähli from Courtelary.

**MEM:** I got to know Stähli<sup>1</sup> in 1955. He lived in St Imier near Biel. There were five members in the key group, which was made up of Schneider, Bandi, Schär, Stähli, and Willenegger. I invited them to Balgrist in 1956 to a mini-course which I prepared for them. Just prior to this course at Balgrist, I had been to Vienna to visit Böhler. I saw little of Böhler but spent most of the time with his chief residents. Among them were Russe<sup>2</sup> and Trojan.<sup>3</sup> Russe became the chief when Böhler retired and Trojan became chief in the early 1960s. When I visited Trojan in the 1960s, Böhler, who had already retired, came to my lectures and spent some time talking with me. Böhler was famous for his well-organized system of conservative treatment of fractures, which he already established toward the end of the First World War and had brought to a level of perfection. His superb system gave me the idea that we should design a similar system for those whom we were going to treat operatively. You must remember that the Böhler school had no concept of operative treatment of fractures; nevertheless, it had the best system of conservative surgery.

*[Although Maurice Müller dates the birth of his concept to form an organized school of surgical treatment of fractures on what he saw in 1956 during his visit with Böhler, there is evidence that the establishment of his circle of chief surgeons from the Canton of Bern in the early 1950s was the germ of his idea to form a team of surgical disciples who would help him establish a school of fracture surgery.]*

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1 Walter Stähli (1911–2009) was chief at the Courtelary District Hospital in Saint-Imier from 1945 to 1981.

2 Otto Russe (1913–1983) was appointed director of the Accident Hospital in Vienna, where he served from 1955. In 1973, he took the position of director of the Accident Clinic of the University of Innsbruck.

3 Emanuel Trojan (1919–2011) studied with Lorenz Böhler. From 1966 to 1989, he worked in the trauma clinic at the General Hospital in Vienna. From 1971, he was professor of trauma surgery at the University of Vienna.



### The meeting at Balgrist in 1956

**JS:** Maurice, you maintain that having seen Böhler's carefully organized system of nonoperative treatment of fractures, you were inspired to organize a similar system for operative treatment of fractures that would be based on principles to guide surgical treatment and postoperative care.

**MEM:** I began to develop this idea just before I held the course at Balgrist in 1956 for my five close friends: Schär, Bandi, Schneider, Willenegger, and Stähli, all chiefs in their hospitals. Imagine—they came for three days during which I gave lectures and demonstrations. I took them to see all my patients at Balgrist, so that they could see for themselves the advantages of stable osteosynthesis. I showed them a case of hip arthrodesis in a man who on day five was already out of bed and able to walk with crutches without bearing weight with only plaster shorts as immobilization. You see, I modified Brittain's technique of hip arthrodesis. Brittain<sup>1</sup> placed a horizontal cortical graft between the pelvis and the femoral shaft. In my modification, the cortical graft was vertical and was inserted in a groove, which I prepared in the bone above and below. With this modification, it was possible for patients to get up out of bed early in short pants of plaster of Paris, so that they could become mobile and move their knee. These were adults in their early twenties. In those days, it was usual for a patient with a hip arthrodesis to spend at least three months in a long-leg hip spica in a hospital bed. I showed my friends a great variety of cases, some of which were pure orthopedic cases and some injuries, like tendon and ligament ruptures, and foot injuries.

I also had posttraumatic complications like pseudarthroses. I was able to show them one case, which was subsequently published with similar cases in my article in 1958 with Martin Allgöwer<sup>2</sup> on the treatment of pseudarthrosis without resection of the pseudarthrosis tissue and without a bone graft, but treated with absolute stability by means of compression.

**JS:** Maurice, it is not quite clear to me how you were preparing this group of close friends, who were general surgeons, to disseminate your theories of the operative treatment of fractures.

**MEM:** Well, it is very clear. Whenever we were together, I made sure that I spoke to them about fracture treatment and I also strongly encouraged them to try these techniques of absolute stability in the treatment of their fracture patients. They saw me use stable internal fixation in elective orthopedic cases. I also spoke to them about fracture treatment and how we could improve the results. They did try some cases using Danis' plate, but mainly for fractures of the forearm.

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1 Herbert Alfred Brittain (1904?–1954), Hunterian Professor of the Royal College of Surgeons, was the first orthopedic surgeon at the Norfolk and Norwich Hospital.

2 Müller ME, Allgöwer M. Zur Behandlung der Pseudarthrosen. *Helvetica Chirurgica Acta*. 1958;25:253. German.

I also spoke to them about my vision of creating a system of operative fracture treatment on a large scale, not only for Switzerland but ultimately as an international standard. We would use the model that Böhler established for conservative treatment for our system based on the principles of stable osteosynthesis, which I had worked out toward the end of my stay in Fribourg. The incredible surgical results I had achieved in Fribourg convinced me to write down the principles of treatment, which would be the basis for a system of operative fracture care, with great emphasis on documentation of each case, including the outcome. This was the message that fired up the imagination of my friends. I felt that we were almost ready to create an association for internal fixation of fractures.

One year later in the spring of 1957, I delivered an important lecture on form and function in orthopedic surgery and fracture treatment in the *aula*, the convocation hall in Zürich. The relationship between form and function was an important concept in the development of my theory of stable osteosynthesis as the basis for the new school of bone surgery that was gradually evolving in my mind. During my residency, I came to recognize that bone is a living tissue and that we must preserve its blood supply to ensure that we are dealing with living bone because dead bone cannot heal. The key principle of operative fracture treatment is based on the fact that only normal form guarantees normal function. Restoration of normal form requires open reduction. To maintain open reduction, internal fixation is required. To guarantee healing of bone after open reduction, absolute stability is mandatory and is achieved with the help of compression. Also, absolute stability abolishes postoperative pain and makes immediate rehabilitation of soft tissue and joints possible.

*[These few words capture the essence of the concept of fracture treatment that Maurice developed.]*

This lecture in Zürich on form and function and my book *Proximal Femoral Osteotomies* were my main achievements in 1957.<sup>1</sup> You must remember that although I was not directly involved in fracture treatment, it never left my thoughts.

“ The relationship between form and function was an important concept in the development of my theory of stable osteosynthesis as the basis for the new school of bone surgery that was gradually evolving in my mind. ”  
MEM

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1 Müller ME. *Die hüftnahen Femurosteotomien: Unter Berücksichtigung der Form, Funktion und Beanspruchung des Hüftgelenkes*. Stuttgart: Georg Thieme Verlag; 1957. German.

### The first meeting with Martin Allgöwer in Chur: autumn, 1957

**JS:** Maurice, was Martin Allgöwer a member of the group at this time? Did he have an opportunity to listen to your thoughts and lectures?

**MEM:** No. Not at the beginning. I did not meet Martin Allgöwer until I left Balgrist in October 1957 (**Fig 15a**). When he became chief in Chur in 1956, Martin told Hans Willenegger that he didn't know what he would do with the flood of fractures that he expected to inundate his hospital that winter, as it had the winter before. Willenegger recommended that he meet me because I could do operations that exceeded anything one could imagine (**Fig 15b–c**). Willenegger assured Martin that I would solve his winter problem. He is supposed to have said, “If you operate on your fracture cases they will stay in hospital only a short time. That will be your solution.”

Martin told Willenegger that he knew me by reputation. It came about this way. Martin is one year my senior. Our military service in Switzerland is organized according to our date of birth. When we finally met, he told me that the soldiers, with whom he served, had talked about me almost every day. I was a *Welscher*, that is one from the French-speaking part of Switzerland, and the *Welscher* were not thought of very highly in the German part of Switzerland. Somehow, I was an exception, since I did extraordinary things every day. They said that despite being the smallest in the group I was the best shot and the best with hand grenades in distance and accuracy, but not so good in the 100-meter race. It's true; I had the most accurate shot when it came to a revolver or rifle and I was the best with grenades. I managed to beat them in the obstacle race as well. They kept saying that I consistently beat the German-speaking Swiss. I also did many card tricks and magic for the officers. They kept saying, “Yes, he is a Bieler (from the city of Biel) but he is quite special, and to top it off, he also speaks fluent German.” Martin never forgot my reputation in the army, and when we first met in the fall of 1957, he reminded me of those early army days.



**Fig 15a–c**

**a** Maurice with Martin Allgöwer.

**b–c** Maurice in the operating room.

**MEM:** I left Balgrist on a Friday; Martin got in touch with me the following Monday and invited me to visit when it would be convenient for me. I told him that I was as free as a bird, that I had just left Balgrist, and could come anytime.

Three weeks later I arrived and told him I was ready to do a couple of his hip cases. He had never seen a hip case, except, of course, for fractures. I did two intertrochanteric osteotomies on two patients with arthritis of the hip, which was one of my specialties. He said that he had never seen anything like it. He was referring not only to the surgery itself but also to my careful preoperative graphic plan. He was also most impressed with the armamentarium of instruments and implants that I had brought along. After the surgery, he took me on a tour of his trauma department. He had three large rooms filled with fracture cases: one room for men, one for women, and the third for private patients. Over lunch he asked,

“Well, what do you think of my trauma department? I was particularly happy to have had a case with an intramedullary nail to show you.”

I told him I was impressed. All his patients were doing well, and all wounds were healing nicely.

Then he said, “Maurice, I have a feeling you are trying to be very nice, but you are not quite in agreement with all that you have seen.”

I then said that I would not have used a 10 mm nail but at least a 12 or a 14 mm nail in a large, young male, particularly because of his large intramedullary canal.

Martin replied, “But that is not possible. His femur would explode!”

I replied, “Yes, but I always ream the medullary canal until it can accept a suitable nail, and in a big, strong, young man you need a stronger nail.”

He replied, “What! Ream the medullary canal? I have never heard of anything like that.”

Now imagine, here was a trauma surgeon leading a hospital full of patients with ski fractures and other traumatic injuries who had not heard of intramedullary reaming! It was very clear that he had no idea about more progressive treatment of trauma care. Then to demonstrate, I took out my intramedullary nails from the trunk of my car and showed him the assortment of nails I had with me.

He pointed to an 18 mm nail saying, “That is surely for an elephant.”

I said, “No, that is for an elderly patient with a large intramedullary canal and especially for one whose primary nailing went on to a nonunion. It is rare that one would need such a large intramedullary nail, but there are indications.” Again, I went to my car and took out all my instrumentation and implants, such as screws, plates, angled plates, and so on. He marveled at all of it. He had never seen anything like it. Remember this was late 1957. He was particularly interested in my screws. I told him that all spiral tibial fractures would be treated with lag screw fixation. That was also news for him. After that he remained quiet. As I was leaving, he invited me to come again.

“ Now imagine, here was a trauma surgeon [Allgöwer] leading a hospital full of patients with ski fractures and other traumatic injuries who had not heard of intramedullary reaming! ” MEM

### The second meeting with Martin Allgöwer in Chur: 1957

**MEM:** My second visit to Chur was three weeks later, close to December. Martin showed me two patients with hip problems. One was a case of a cox arthrosis, but the second was much more complicated. It was a nonunion of the femoral neck without any sign of avascular necrosis. Once again, we did two intertrochanteric osteotomies. The first was a straightforward varus intertrochanteric osteotomy. The nonunion was much more complicated since it required a repositioning osteotomy, which would place the nonunion under axial compression. Martin marveled at my templates of the angled plates and how I calculated all the steps with lateralization of the shaft to maintain normal biomechanical loading of the extremity. He was beginning to understand the importance of careful preoperative planning and could see that reconstructive orthopedics required greater knowledge than fracture treatment alone.

### The third meeting with Martin Allgöwer: 1958

**MEM:** Martin and I decided that I would come again in January 1958. We had agreed that on this visit I would demonstrate some of my results. Fortunately, documentation was one of my strong points. I had always tried to document all my cases to provide a body of evidence. When I showed him what I had done, he said:

“This has to be published right away. You cannot sit on such material; you must show others what you have been doing. No one in Switzerland can do any of these cases, which you have done so masterfully.”

He wanted to know who else was involved in what I was doing. At his hospital he was the one to assist me; he would not let anyone else see what we were up to. Since I had been an itinerant surgeon before I left Balgrist in 1957, many had become interested in what I could do. As you know, the surgical community in Switzerland is not large; the word spread quickly, and all were interested to find out.

**JS:** What sort of cases had they lined up? Were these cold orthopedic cases or fractures?

**MEM:** Most of the cases they showed me were difficult acute fractures which they would have treated nonoperatively because they didn't know any better. They asked me to come because they thought I might have a better method.

**JS:** Maurice, that meant that as soon as you left Balgrist your trauma practice picked up?

**MEM:** Yes, that's true.

**MEM:** In January 1958, Martin and I decided that we would publish the cases of pseudarthrosis, which I had treated with compression, without resection of the pseudarthrosis tissue, and without a bone graft. I had good documentation of all these cases, particularly the cases I did at Balgrist. Martin insisted that we publish this material. He was a committed academic surgeon and at the same time, he had political instincts and understood how to spread the word in print. He had connections everywhere in Switzerland and made sure that the article appeared in the *Acta Chirurgica Helvetia* within the first six months of 1958.

“*When I showed him [Allgöwer] what I had done, he said: ‘This has to be published right away. You cannot sit on such material; you must show others what you have been doing. No one in Switzerland can do any of these cases, which you have done so masterfully.’*” **MEM**

**JS:** Were you the only author?

**MEM:** Well, no. Martin was included. Since he was so keen and had all the connections to get it in print as quickly as possible, I made him my coauthor. This work was published in August 1958.

The next thing we agreed upon was to reactivate the group I started in 1956 when I invited my friends to Balgrist. Martin wanted to know which surgeons I had worked with. I explained that they were the friends whom I got to know through Schneider: Schär, Bandi, Stähli, and Willenegger. I told him about the three-day meeting we had had in 1956 at Balgrist and how much they all appreciated it. I told him that I had promised these surgeons and a few others that we would organize a group during 1958 to promote osteosynthesis as the preferred method of fracture treatment. Immediately, Martin had a great idea.

He said, “Why don’t we make a similar meeting, but this time invite them to my hospital in Chur, and besides the five you invited to Balgrist, let us invite all others with whom you have worked.” This is how the meeting in Chur on March 15, 1958 came about.

#### Meeting in Chur, March 15–17, 1958

**MEM:** Invitations for this meeting on March 15–17, 1958 had been sent to: Walter Bandi, Ernst Baumann<sup>1</sup> from Langenthal, who had designed the first Swiss lag screw, Leo Eckmann,<sup>2</sup> August Guggenbühl,<sup>3</sup> who had been Willenegger's chief resident in Liestal and who had just taken over as chief in Grenchen, Willy Hunziker<sup>4</sup> from Belp, Clemente Molo,<sup>5</sup> chief in Bellinzona, Robert Nicole,<sup>6</sup> Walter Ott,<sup>7</sup> René Patry,<sup>8</sup> the director of the surgical polyclinic in Geneva, Walter Schär, chief in Langnau, Robert Schneider, chief in Grosshöchstetten, Walter Stähli from Saint-Imier, and Hans Willenegger from Liestal, the most experienced traumatologist of the whole group. Martin had invited Dr Hunziker whom he knew from his studies; I knew the others well, since I had done surgery at most of their hospitals.

Of those whom we invited, Molo, Patry, and Nicole did not come. Eckmann came only for the dinner and did not really join the group. He tried to keep some contact with us but was never quite ready to declare himself. However, Bandi, Baumann, Guggenbühl, Hunziker, Nicole, Ott, Patry, Schär, Schneider, Stähli, and Willenegger were taken in as founding members.

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- 1 Ernst Baumann (1890–1978) was chief of medicine in the District Hospital of Langenthal from 1928 to 1960.
  - 2 Leo Eckmann (1923–2011) had been in the University Clinic in Basel with Martin Allgöwer. Later he became professor and chairman of the department of surgery at the University of Bern and chief at the Tiefenau Hospital.
  - 3 August Guggenbühl (1918–2009) was chief of surgery at the Grenchen Hospital in Canton Solothurn.
  - 4 Willy Hunziker (1915–1987) was chief of surgery and obstetrics at the District Hospital in Belp.
  - 5 Clemente Molo (b. 1909) was chief of surgery at San Giovanni Hospital in Bellinzona from 1946 to 1974.
  - 6 Robert Nicole (1903–1991), a friend of Martin Allgöwer, was the chief and professor extraordinary at the Children's Surgical Clinic at the University of Basel from 1946 to 1973.
  - 7 Walter Ott (b. 1915) was chief of surgery at the hospital in Rorschach from 1954 to 1977.
  - 8 René Patry (1890–1983) was director of the University Surgical Clinic in Geneva from 1948 to 1968.



**JS:** Why did you invite these additional members to join your original group?

**MEM:** The first and important reason is that these were the surgeons with whom I had worked, in whose hospitals I had operated, who had listened to me many times, and had more than just an idea of what I was trying to establish. They understood this was going to be the creation of a group of friends, who were coming together to found a new surgical philosophy and a new form of treatment. I knew all of them intimately, all except for Hunziker, and I was more than ready to vouch for the sincerity and eagerness of all, as well as their ability.

You must also realize that six of us were from Canton Bern: Schneider, Bandi, Baumann, Schär, Stahl, and myself. To paint an accurate picture for you, these were the people who shared my background. With some I went to school. Some families knew each other. The older ones were not direct contemporaries, but they shared the same background and had been members of the same athletic clubs and medical fraternities. We Bernese had much that linked us together. We trusted one another and felt a deep bond, almost like a brotherhood, and were not ashamed to show each other our cases and mistakes.

*[Maurice recognized that his “team” was one of the most important keys to his success. They were linked by common experience: their early schooling, similar family backgrounds, sports, medical schools, and fraternities. They had a deep sense of kinship and absolute trust. Their positions as surgeons-in-chief in their small district hospitals gave them the absolute right to embark, without censure, on whatever form of treatment they wished. The help they received from Maurice with their difficult cases improved the reputation of their hospitals, as well as their own, since patients could expect a better outcome. They also learned a great deal from Maurice who made them his pupils and disciples.]*

**MEM:** Ernst Baumann was president of the Swiss Association for Trauma Surgery. He had also designed a Swiss lag screw. Patry was the vice president of the Swiss Surgical Society. A year later he became president. It was important for us that in the late 1950s we had the president of the Swiss Surgical Society as one of our members. I operated at his hospital every month in 1957 and then again in 1960.

This meeting in Chur not only allowed us to review in detail the state of the art of internal fixation as it existed at that time but more important, we were able to discuss the emerging ideas and the existing instrumentation of the day. We all agreed that something had to be done if we wanted to standardize treatment. We could not work in operating rooms where the available material for bone fixation was frequently mismatched and in poor condition. I had told my friends repeatedly that we had to create a new instrumentation and new implants. A thorough review of what was available and assessment of the shortcomings, some of which became evident during our hands-on exercises, motivated the group to give me the green light to do something about it. The group appointed me in charge of development of a new set of implants and instruments.

We also had time to discuss, reflect, and socialize. At the end, we were all of one mind that we would create our own association for osteosynthesis. At this point Martin, who had a nose for politics and understood academia, intervened and said that we must create a society for “the study” of osteosynthesis. He was right, and he kept reminding us over the years of this small change, which proved to be so important.

“ We were all of one mind that we would create our own association for osteosynthesis. At this point Martin, who had a nose for politics and understood academia, intervened and said that we must create a society for “the study” of osteosynthesis. ” MEM

### The association for the study of osteosynthesis

**MEM:** The members whom I decided to include in the group were as follows: (Fig 16). First, Professor Patry, vice president of the Swiss Surgical Society from Geneva, who was to be president in two years. The second was Baumann, a trauma surgeon who worked with SUVA-Schweizerische Unfall Versicherung (the Swiss Accident Insurance Company), which paid disability insurance to patients whose fractures resulted in impairment. He also had a hospital job as a trauma surgeon and had designed the original Swiss lag screw. The next was the group of surgeons with whom I had worked: Willenegger, Schär, Stähli, Bandi, Schneider, and Ott. Walter Ott was chief surgeon in Rorschach where I had operated frequently. Then I decided we should take Guggenbühl, who had followed me at Liestal as Berger's chief resident after I left in 1950. He subsequently became the chief resident of Willenegger, who had succeeded Berger when he retired. Then came Fritz Brussatis.<sup>1</sup> He was a neurosurgeon who came to Balgrist to instruct me in disc surgery. He subsequently gave up the idea of neurosurgery and completed his training in orthopedics. And then, of course, Martin Allgöwer joined in 1958. Allgöwer proposed that we invite Hunziker from Belp, as he had promised him an invitation if we were to create a group. But Hunziker came only once and never showed up again. Ott, with whom I operated in Rorschach, was a friend of Hans-Ulrich Buff, the chief resident in general surgery at the university clinic in Zürich who had become by now an enemy because I had decided to collaborate with Allgöwer and not with him. He and Allgöwer were contemporaries and rivals.

**JS:** Maurice, what happened between March 1958 and the actual meeting during which you formally established the group?

**MEM:** Well, that was to be in the late fall of 1958. I reminded the group that the Swiss Surgical Society would meet in Bern in the fall of 1958 and that this would be an ideal time to establish our association. We would meet in Biel in early November. Since Biel was my home and Schneider's as well, it was an appropriate place for the founding of our association. I pledged that I and my sister Violette would prepare a new "armamentarium" to be ready for this event.

<sup>1</sup> Friedrich Brussatis (1919–1989) became director of the orthopedic clinic of the Johannes Gutenberg University in Mainz in 1969.



**Fig 16** The most important founding members of the Swiss AO. Clockwise from the top left: Martin Allgöwer, Maurice Müller, Hans Willenegger, Robert Schneider, Walter Bandi.

### The design of instruments and implants

**JS:** Maurice, let me clarify what you mean by an “armamentarium.” Was that the beginning of the creation of new instrumentation?

**MEM:** Well, no. I had been preparing for this for quite a long time. As I have mentioned, both Van Nes and Danis stressed the importance of designing and creating one’s own instruments and implants. In 1952, I had already modified Charnley’s compression clamps to the ones I designed with threaded connectors to be used with Schantz screws or Steinmann nails for compression as well as for distraction. After the external compression clamps came the screwdriver with a handle with a rectangular profile. Then I modified the Hohmann retractors and designed new ones with both narrow and broad tips. Then came some special bone chisels and gauges, straight and curved, and then a set of special osteotomes. I also designed a special drill bit for bone and adapted a power drill (ARO-Motor) for more precise drilling of bone.

**JS:** When did you design the angled blade plates?

**MEM:** During the years I spent at Balgrist, I worked with the existing angled blade plates, such as those of Blount and others. These are illustrated in my book on proximal femoral osteotomies. I had carefully noted what I considered to be their shortcomings. In late 1950s and early 1960s, I designed new angled blade plates. The important features of these were the special “U” profile of the blade portion and the different angles and different off-sets to preserve the normal anatomical-biomechanical relationship of the femur, despite changes in the angle of inclination of the proximal femur after an osteotomy.

**JS:** You met Robert Mathys in April 1958.

**MEM:** Yes, that is correct, on April 7, 1958. I had drawings which I made before my meeting with Mathys (**Fig 17a–c**). When I met him, I was looking for someone who could make a new screw for me. Previously, I had been using material of about six different implant manufacturers. In the spring of 1958, I designed the 4.5 cortex screw with a special thread. This screw was undoubtedly an important breakthrough in the design of a bone screw. The head of the screw was rounded and had a hexagonal recess to couple with the hex profile of the screwdriver tip. The thread of the screw was designed to withstand pull-out and provide optimal holding power and compression. This determined the ratio between the diameter of the shaft and the diameter of the thread, as well as the angle subtended between the thread and the shaft. The greater the surface area and the closer the angle was to 90 degrees between the thread and the shaft, the greater the holding power of the screw. It was a non-self-cutting screw and required a tap (thread cutter) to minimize the damage to bone by the dullness of the threads of a self-tapping screw. It also made the process much more accurate. Mathys, as an expert on screw design, was very helpful.

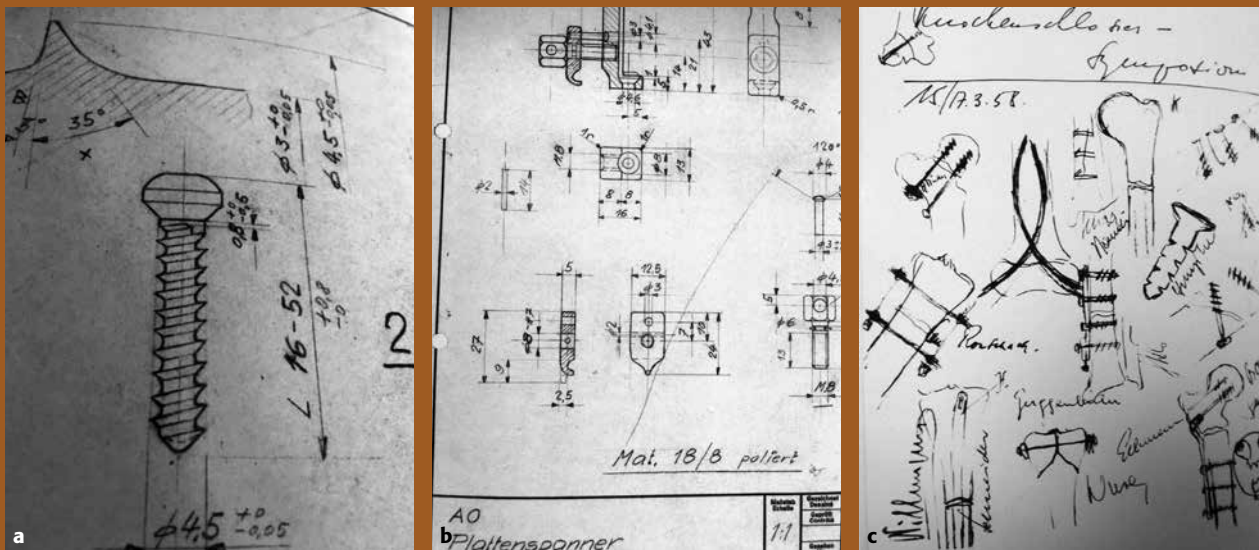
After the screw came the straight plates with the round holes and the external tension device or compressor, which we used in conjunction with the plates to achieve axial compression. The condylar blade plate and the 90 degree and 130 degree blade plates were not ready until 1960.

“*In the spring of 1958, I designed the 4.5 cortex screw with a special thread. This screw was undoubtedly an important breakthrough in the design of a bone screw.*” MEM

I also designed a new intramedullary nail which was made from a tube. The proximal part of the nail was threaded on the inside which allowed an accurate and stable coupling between the nail inserter or remover. This design feature ended the nightmare of nail removal, which was frequently encountered when removing an original Küntscher nail that depended on the coupling between the hook of the extractor and the oval holes in the proximal part of the nail. This threaded connection was suggested by Schneider and came three years later.

**JS:** It seems that by the time the new group was coming together, you had already designed and manufactured several of the components of your own instrumentation?

**MEM:** Well, by the time the first course was held on December 10, 1960, we had our full set of instrumentation and implants. This was a great accomplishment on my part to design everything on time. Of course, Mathys not only had to have the armamentarium ready but he also had to have produced enough copies for all participants to use in the first course on simulated fracture models. We used human formalin-preserved bones, which we prepared by creating some basic fracture patterns. The use of human bones was messy, but we were using an authentic material with a real feel to it. The participants would also be using the same screws, plates, and nails of our design that they would use in an operating room.



**Fig 17a-c**

- a The design of the famous cortical screw.
- b Details of designs for new instrumentation.
- c The cover of the program for the second instructional session that Maurice organized for his friends in Chur on March 15, 1958.

The entire armamentarium was organized in five cassettes, color-coded and organized according to application and use. This greatly facilitated instrument preparation and handling. It brought order to a chaotic world where nothing was standardized and where it was common in an operating room to see a mixture of screws and plates from different manufacturers, sometimes even made of different material, with screws that did not match the holes in the plates. The five cassettes included the angled blade plates and the intramedullary nails. By December 1960, I had not only completed the design of all the instrumentation and implants but we also had time to make at least twenty complete sets of five boxes for the first course in Davos.

**JS:** In 1952, you had designed the external threaded fixator mostly for compression, but it could also be used as a distractor during surgery, as you did for a while. When did you start with plates?

**MEM:** When I visited Danis in 1950, I saw him use his lag screws and plates to achieve compression. I bought these when I started in Fribourg and used them for the internal fixation of the first seventy-five tibial fractures, which I treated during my stay there. When we started to work as a group, we began with the lag screw and plates of Danis. However, because I kept complaining about the instrumentation and how inadequate some of the things were, the group said, "Fine Maurice, you design an entire new instrumentation with implants and instruments, so that we will be not only the pioneers in this new association for the study of internal fixation but will also have the implants and instruments that are needed. These should be specifically designed for different purposes and will represent the optimum available."

Look, in addition to the implants, I had designed many things over the years. For the external compressor clamps I designed the 4 mm and 5 mm Steinmann-like nails. Then for bone surgery, I modified the broad Hohmann retractors into retractors with narrow tips, to minimize the soft-tissue stripping from the bone. The original Hohmann retractor was a broad retractor designed to be used in combination with a chisel while transecting bone. The Hohmann was meant to stop the chisel from plunging into soft tissue. The narrow-tipped Hohmanns proved ideal as retractors.

**JS:** But today we call all these Hohmann retractors. Is that wrong?

**MEM:** Yes, it's wrong. In France, they call the narrow-tipped retractors Müller retractors. However, I did not want the implants to be called by my name. I was designing these to be used under the name AO and I wanted all the instruments to be referred to collectively as AO instruments. I did not want my name attached to any one instrument or implant. Around the middle of 1950, I also designed a number of intraoperative angle guides, to be used together with the angled plates, as well as templates for preoperative planning.

**JS:** What else did you have besides bone retractors, compressors, plates, screws, and screwdrivers?

**MEM:** Well, I adapted a power drill to be used instead of hand drills. One cannot make a proper hole in bone with a wobbly hand drill.

“ In France, they call the narrow-tipped retractors Müller retractors. However, I did not want the implants to be called by my name. I was designing these to be used under the name AO and I wanted all the instruments to be referred to collectively as AO instruments. ” MEM

**JS:** Did you have that before 1958?

**MEM:** Yes. The semitubular plate appeared in 1961. Prior to it, I already had my own intramedullary nail. Incidentally, the semitubular plates were made from nails which were being discarded because of a mistake in the manufacturing.

**JS:** Maurice, was that the nail with the threaded portion for insertion and removal?

**MEM:** No. My initial nail was a tube. The threaded portion of the nail was an invention of Robert Schneider; it appeared in 1963. Up to that point I had a nail which was a closed tube at the top in comparison with the open nail of Küntscher.

**JS:** You speak of “my nail.” Küntscher had a stainless steel intramedullary nail well before 1960.

**MEM:** Yes, but the Küntscher nail was not made from a single tube like my nail.

**JS:** What about the Steinmann nail?

**MEM:** No. I had nothing to do with its design, although I adapted it to be used with my threaded external compressors. Steinmann was a Swiss; I knew his son personally. Steinmann's nail or pin was already available in 1909 before the First World War. Böhler was using it for femoral traction by 1915. In 1958, we had our own cortical screw which I designed.

**JS:** Did we have a cancellous screw?

**MEM:** No, at that time we used Danis' cancellous screws. I developed a cancellous screw slightly later.

**JS:** Did Mathys take over the production of your intramedullary nail?

**MEM:** Yes. But not right away. He did this in 1960.

### **The first meeting with Robert Mathys and subsequent collaboration**

**JS:** Let's retrace the history of your work with manufacturing implants?

**MEM:** It began in the early part of my career as a surgeon. You see, I first dealt with Zulauf from Langenthal. Zulauf made my first chisel for me. He was famous. There was a large wood sculpture community in Bern; the artists used to carve beautiful animal sculptures and other pieces out of wood. Zulauf became famous because he made all the chisels for these artists. I turned to him when I wanted to have my first chisel made; I had already designed it in 1952.

I did not meet Mathys until April 1958. I was looking for someone who could make instruments for me, when one day I met a friend of my sister Violette, who owned a metal factory in Biel. I asked him if he knew anyone who understood how to work with stainless steel and who was enterprising and smart. He thought for a while and then said,



“I know a Mr Mathys who has a very small business in Grenchen near Bettlach. See him.”

When Mathys and I met in April 1958, I explained what I was developing and asked whether he was interested. Up to this point Robert Mathys had a small private business making parts for the watch industry; he was an expert on screw design. After listening to me, Mathys said that he was interested. I told him that what he made would not be available for sale right away. I assured myself that Mathys would not put my designs on the market before they were tested. This was not an easy condition for him to accept since it had major financial consequences. But Mathys was not interested only in making money. He was more interested in what I was doing and wanted to become part of it. Despite the rather unusual business arrangement that I was proposing, Mathys seemed taken by the prospect of making something which would be used to help patients (**Fig 18**). Mathys was a most unusual man; he was very much an idealist. Most of the instrument manufacturers with whom I had dealt were always pushing to sell long before I had the chance to put the instrument to use and test its safety and usefulness.

#### The early financial arrangements of the AO

**MEM:** When Mathys and I began to work together, I thought that we should go to a bank to get a loan to establish a company. But then I realized that as a surgeon, I could not design implants and then act in partnership with a manufacturer to market and sell them. It would be a clear conflict of interest that would not only put me in conflict with my colleagues but even more with my own conscience. I could not design a plate and then tell people that they should use it and ask them to pay me. I realized that as a doctor, I would have a major conflict. We had to find some other mechanism.



**Fig 18** Maurice and Robert Mathys working on the design of new instruments in 1958.



At first, my sister Violette was put in charge of sales and finances. Mathys was not paid by the doctors but by my sister. The doctors bought the instruments and implants from my sister. She kept 15 percent for administrative costs. Thus, Mathys never dealt with any of the doctors, only with my sister. Violette made out the invoices; the doctors paid her and she in turn paid Mathys. Sometimes he had to wait for three months before the doctors paid and before Violette could pay him, but he never complained. Sometimes it stretched even longer, yet Mathys became more and more enthusiastic and would rather spend his time making things for me. I am sure that were it not for the fact that he found it absolutely fascinating to join me in the operating room where I showed him and explained to him what was needed and what I had in mind, he would not have agreed to some of the conditions.

Mathys was a genius. He seemed to understand intuitively what I needed and what would work. We began to develop an unbeatable team. He was an expert at making screws. His father was a builder but was never involved in any large enterprises. They were good at what they did, but the son's imagination was fired up by what he was doing in an intellectual partnership with me. It lit a spark in him to be involved in doing something which helped the sick. Since Mathys was an expert with screws, I started with the design of a cortical screw as the first implant, before we moved into other things.

#### Organizing the AO

**JS:** Now Maurice, let's back up a bit. You have talked about a group of people who came together and collectively founded the AO. What I would like to do now is to examine, at some length, the contribution of each of these individuals. You have described all that you contributed and how you fired up the imaginations of your colleagues, how you worked with them, how you taught them and improved them as surgeons, and how you moulded them into a team. You gathered around you some very talented people. How did they contribute and help the young AO succeed? For instance, what about Martin Allgöwer? Was he an organizer? Did he push things forward?

**MEM:** No, no. Martin knew nothing about organization. That was certainly not his forte. He was unquestionably the most famous, young general surgeon in Switzerland. He was known as a researcher and had spent a year in Galveston, Texas, from 1951 to 1952. He did that while he was still a chief resident, working for Professor Nissen in Basel. He took a year out of his training to do research on burns in the United States. When he came back he was fluent in English; that was a great advantage when dealing with surgeons from abroad. He was also an academic and a diplomat and had a great sense of humor.

“*Mathys was a genius. He seemed to understand intuitively what I needed and what would work. We began to develop an unbeatable team. He was an expert at making screws.... It lit a spark in him to be involved in doing something which helped the sick.*” MEM

**JS:** What about Schneider?

**MEM:** I had four friends on whom I could always depend, who always gave me their support: Schneider, Bandi, Willenegger, and Martin Allgöwer (**Fig 19**). The five of us had, so to speak, the “AO lever” in our hands and we made most of the decisions for the AO group.

**JS:** How did Bandi help you?

**MEM:** Just as Martin was very important in Canton Graubünden in the east part of Switzerland, Bandi was similarly important in the Berner Oberland, the south east. He worked in Interlaken. His clinic collected all the fractures from the Berner Oberland (the Jungfrau area), sorted them out, and referred the more difficult cases to Bern for treatment.

**JS:** Maurice, can you describe how your colleagues helped you form the organization and move it forward?

**MEM:** The members of the group did not help me form the organization. They did not drive it forward. I had to do all that by myself. I was the driving force; I organized everything, and in the end, I had to write the outline of the constitution and the by-laws.



**Fig 19** The members of the Board of Synthes AG Chur. From left to right: Hans Willenegger, Robert Schneider, Maurice E Müller, Peter von Rechenberg the chairman, Martin Allgöwer, Walter Bandi.

### Establishing the laboratory for research and the documentation center

**JS:** Maurice, let's discuss the issue of intellectual property. It is clear that you patented every implant, screw, plate, and instrument that you designed. This represented your intellectual property. No one else contributed to the design and development in any way. You drew up the designs, you patented the work, and Mathys worked completely according to your designs and specifications.

**MEM:** Yes, that is the case. The value of our intellectual property was connected to the important principles of research and documentation. Let me explain.

I had conceived of the creation of a new school of surgery that would be for the operative treatment of fractures what the Böhler school represented for conservative treatment of fractures. I realized that we would have to support our work with animal experimentation to provide evidence for our methods. I could foresee the days of evidence-based medicine. The days when the opinion of a famous professor was considered to be absolute truth would soon be over. I could see that to succeed we would have to have both clinical and experimental evidence. With that in mind, I told Martin in early 1958 that we needed to organize a research laboratory and a documentation center. Because we were short of funds, Martin suggested that we look for lab space in Davos. It had been famous for the treatment of tuberculosis, but since the introduction of antimicrobials most of the facilities were empty. Through a friend, Martin contacted the right people in Davos to find a space. We started first with a simple room and gradually expanded.

In addition to the laboratory, we opened our first center for documentation. I understood the importance of documentation from the very beginning of my work as a surgeon. Little documentation was done, at least in Europe. Van Nes had virtually no documentation. Danis had a form of documentation but it consisted only of drawings, like those of his chief, Lambotte, done fifty years before. When I asked Danis if he had done any animal research, he replied that he worked alone with only his own funds, and was not able to do any research. He had a workshop but not a laboratory—nothing of the sort. He relied entirely on the results of his clinical work.

The visit to Böhler in Vienna in 1956 strengthened my belief in careful documentation of results. Documentation was one of the keys to Böhler's success, and I was certain it would be the key to ours. Once we started the documentation center in 1959 in Davos, we learned how to miniaturize x-rays. This made it possible to document x-ray images. I then designed special forms: A, B and C. These had patient data coded by means of perforations along their periphery and a space in the center where we attached miniaturized x-ray photos from the various stages of treatment. To my knowledge, this was the first documentation that included images of cases. Everything was documented in a prospective fashion. These would be the facts used to convince those who doubted us. The documentation of images also proved invaluable in producing slides for education.

“ *The visit to Böhler in Vienna in 1956 strengthened my belief in careful documentation of results. Documentation was one of the keys to Böhler's success, and I was certain it would be the key to ours.* ” MEM

“ *We were at the forefront of evidence-based medicine.* ” MEM

**JS:** How well received were your ideas about documentation?

**MEM:** It was difficult to convince my colleagues to document prospectively, since it is a time-consuming discipline. However, they respected what I had to say and agreed to adopt documentation from the beginning. It was only when we ran into strong opposition to what we were doing that they appreciated the value of prospective documentation. It won the day for us. We were at the forefront of evidence-based medicine.

Once we started to record our evidence, we realized that we also needed to classify fractures. We had to begin to collect “likes” with “likes” and establish criteria that allowed us to sort our cases. In the mid-1960s I had already developed a preliminary form of classifying fractures. It would take another thirty years before I published *The Comprehensive Classification of Fractures of Long Bones*,<sup>1</sup> a work which crowned years of effort.

**JS:** Was the group enthusiastic about the need for research?

**MEM:** It was easier to convince them about research. The importance of research became obvious to me when I met Van Nes and Danis. When I was in Leiden, I saw that Van Nes had created a modern hospital; not only did it have an amazing clinical volume but also a great deal of research was being done. On the other hand, one of Danis' great failings was that he had only human cases to show and no research. If we were going to be successful in developing a new form of fracture treatment based on surgery, we had to have research findings to back up our ideas. No one had done any experimental work on bones fixed with absolute stability. Thus, in the summer of 1958, we opened a simple laboratory for experimental surgery and established the documentation center at the same time.

**JS:** What kind of research did you do?

**MEM:** Martin was the right partner. He understood the importance of research and was eager to get going. He also understood the importance of documentation, as well as publishing one's work to gain academic status. For a start, Martin continued what he had done before: his work on burns and wound healing. He continued to look for the elusive burn factor. He also restarted his work with cell cultures. He thought that monocytes might be bone precursors; this was an extremely advanced concept for its day.

I knew that funds were needed to continue and expand our research. Already opposition to our work was brewing in the Swiss surgical community and we could not count on financial support from the universities or government. We had to secure the necessary funding and still be fully independent. This is where the importance of intellectual property came in.

“*In the mid-1960s I had already developed a preliminary form of classifying fractures. It would take another thirty years before I published *The Comprehensive Classification of Fractures of Long Bones*, a work which crowned years of effort.*” MEM

<sup>1</sup> Müller ME. *The Comprehensive Classification of Fractures of the Long Bones*. Berlin: Springer; 1990.

### Early financial support

**MEM:** Initially, we had no financial support; at first, funds came from our own pockets. Bandi, Schneider, Willenegger, and I each put up 10,000 francs when we founded our organization. We had no other sources of funding. Then again, when the laboratory for experimental surgery opened, each of us gave another 10,000 francs. The group also agreed that each member of the Swiss AO had to pay 500 francs annually. Martin was also able to raise 30,000 francs in additional funding from a firm interested in burns.

We were proud that we could start without any outside support. It also reveals something about how much we believed in what we were doing and how ready we were to support our initial efforts from our own private funds. I had an idea how to create a system which would ensure self-funding, but for the moment I felt that the time had not come for disclosure of my plans. Some years later, Merle D'Aubigné<sup>1</sup>, the famous French orthopedic surgeon told me that our ability to fund our projects ourselves had been unquestionably the key to our success. If we had had to depend on government and university support, we would have stalled and withered.

“  
*Some years later, Merle D'Aubigné, the famous French orthopedic surgeon told me that our ability to fund our projects ourselves had been unquestionably the key to our success.*”  
MEM

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1 Robert Merle D'Aubigné (1900–1989) was chief of surgery at the Cochin Hospital in Paris, France from 1948 to 1970.





*The third 20 years*

## *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 Brüssatis 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.

### 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,<sup>1</sup> and Kaiser<sup>2</sup> 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.

“ 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

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 pre-clinical 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.

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.

“ *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

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<sup>1</sup> 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,<sup>2</sup> 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.”

- 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.



Fig 21a–b Maurice lecturing.

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<sup>1</sup> 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<sup>2</sup> 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 Internationale de Chirurgie, Orthopaédique, 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<sup>1</sup> and Coventry,<sup>2</sup> 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,<sup>3</sup> 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.

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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<sup>1</sup> 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<sup>2</sup> published an article in the journal *Bone and Joint* about his cases of forearm fractures treated with the Synthes compression plates.<sup>3</sup> This paper really made our reputation in the United States.

After visiting Miami, I went to the Johns Hopkins Hospital in Baltimore, where I knew of Robert Robinson.<sup>4</sup> 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<sup>5</sup> at the duPont Institute in Delaware. I knew his resident MacEwen<sup>6</sup> 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

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...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

1 Harold B Boyd (1904–1981) joined the staff of the Campbell Clinic in Memphis, Tennessee, and was chief of staff from 1962 to 1970. 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<sup>1</sup> and his friend Sir Henry Osmond-Clarke,<sup>2</sup> 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,<sup>3</sup> 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<sup>4</sup> and his friend

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

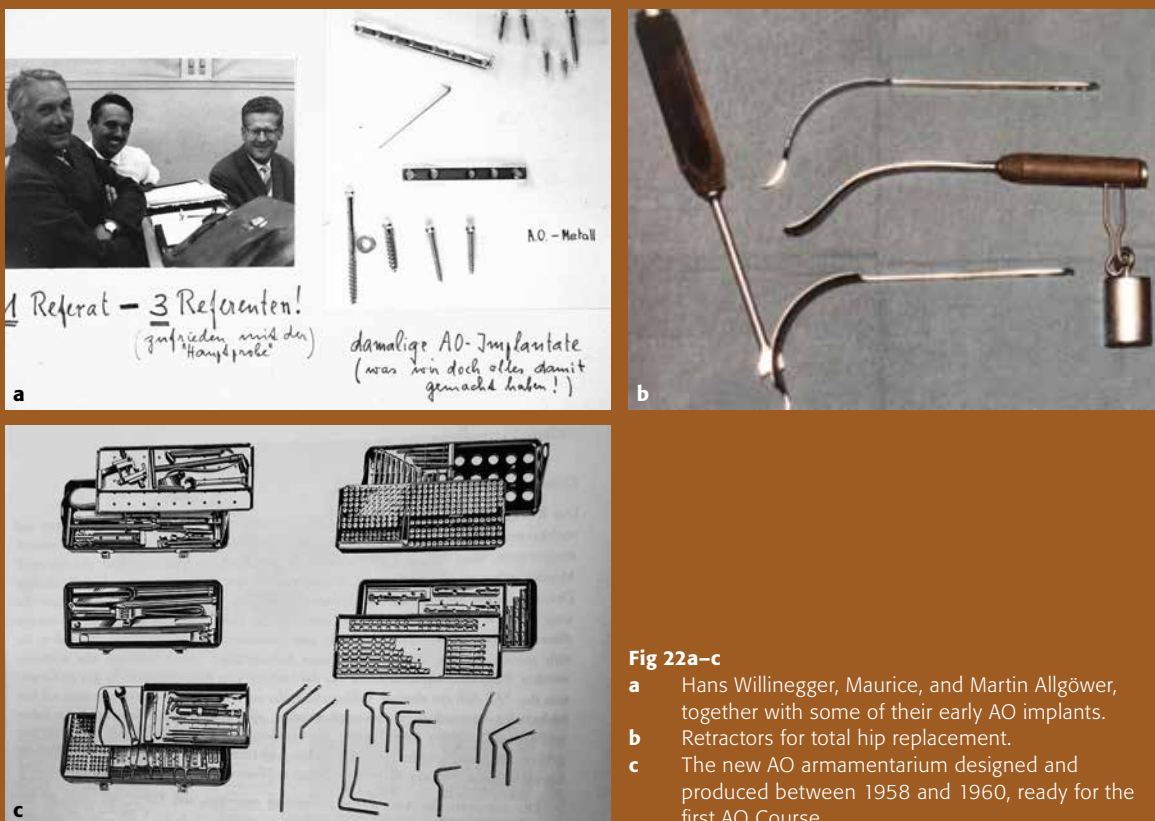
2 Sir Henry Osmond-Clarke (1905–1986) was a consultant at Crumpsall Hospital near Manchester from 1936, and later at the Royal National Orthopaedic Hospital in London.

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.<sup>1</sup> 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 States 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,<sup>2</sup> 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<sup>1</sup> 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<sup>2</sup> came at the end of the year and Dr Boitzky<sup>3</sup> started in February 1961. I also had Dr Vasey<sup>4</sup> 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 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

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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 Boitzky (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 coaptors. 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<sup>1</sup> an orthopedic surgeon, also from Bern, who worked with Professor Dubois<sup>2</sup>. 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.

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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*.<sup>1</sup>

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.

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.

“ 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

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–b**). 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<sup>1</sup> 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.

<sup>1</sup> 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?

**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 distributor 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.

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 distributor. 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.

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

“ ...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



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.

#### 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.

“ 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

*[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 Bangert-er, 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<sup>1</sup> 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.

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<sup>1</sup> 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<sup>1</sup> 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.

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<sup>1</sup> 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.<sup>1</sup> I also had the work of Heinz Wagner<sup>2</sup> 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 air-flow 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

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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.<sup>1</sup> 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.

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<sup>1</sup> 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,<sup>1</sup> who was working on a metal-on-metal prosthesis and another was being introduced by McKee<sup>2</sup> and Farrar<sup>3</sup> 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.

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- 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. 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<sup>1</sup> 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<sup>2</sup> 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.

“ 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

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 Gümliigen. 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,<sup>1</sup> 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.

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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<sup>1</sup> 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.]*

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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.

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 send 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.

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

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<sup>1</sup>, 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

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<sup>1</sup> 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<sup>1</sup> and Preisig<sup>2</sup> received some funding from the government. In the end, I can say that Murtenstrasse 35 began to function as my own university.

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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. 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<sup>1</sup> 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.<sup>2</sup> Joseph Schatzker's English translation published in 1970<sup>3</sup> 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.

“ 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

“ 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

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<sup>1</sup> 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<sup>2</sup> 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

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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.

**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.

“ 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:** 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. Wilenegger 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.

### 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 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

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 distributor 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.

### 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

“ 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

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.

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.

“ 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

**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<sup>1</sup> and Arsène Grosse<sup>2</sup>. 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<sup>3</sup> and Schellmann,<sup>4</sup> 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<sup>5</sup> 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.

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- 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.

**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.

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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

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<sup>1</sup> and Dr Mike Chapman.<sup>2</sup> 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.

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.

“ 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

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,<sup>1</sup> 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.

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

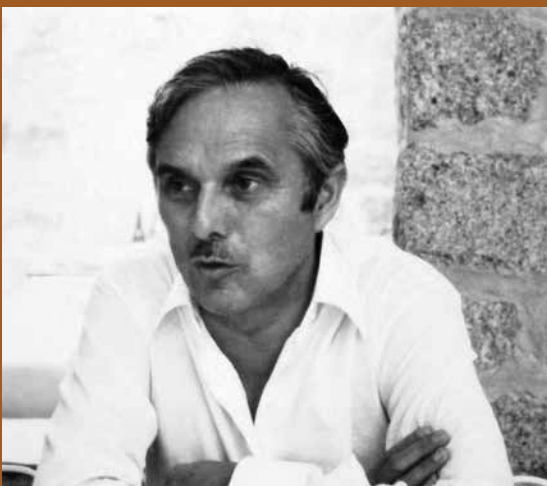


I fully understood that changes were necessary and perhaps well overdue. For instance, our expectation to have people donate their intellectual property to the AO had become naïve. Synthes' competitors were rewarding creative surgeons with a great deal of money. The AO was out of step with the rest of 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.

### 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.

*“ 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*

**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 Murtenstrasse 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<sup>1</sup> 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.

<sup>1</sup> 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.

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.

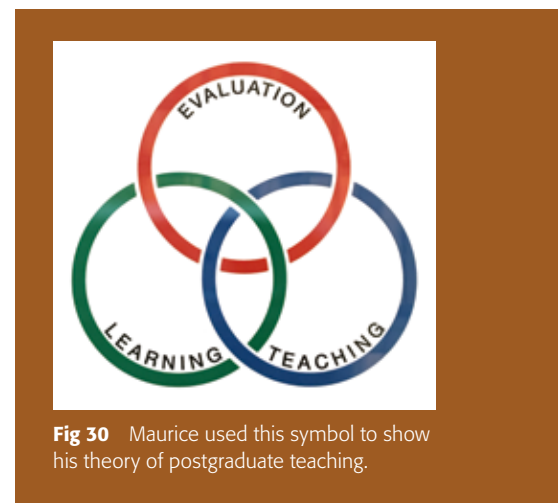


Fig 30 Maurice used this symbol to show his theory of postgraduate teaching.

“ 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.<sup>1</sup> He made important observations which helped with the classification of these difficult fractures.

**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*<sup>2</sup>, which I published with Serge Nazarian<sup>3</sup> 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.<sup>4</sup>

**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

“ 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

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*.<sup>1</sup>

“*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

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



*Final years*

## Final years

All through his life, Maurice was curious, energetic, and happy when he was active and involved. He was an enthusiastic skier and traveler. As much as he enjoyed his work, he also enjoyed an active social life. In his mid-eighties he began to develop health problems. In 1993, at the end of his term as chair of the SICOT Standing Committee on Documentation and Evaluation, Maurice entertained the committee members at a reception in his beautiful and spacious family home on the shores of Lake Biel and then for dinner at a neighboring hotel. The party ended late at night. Driving home, Maurice, alone in his car, must have dozed off because the car ran into a wall. Maurice sustained a stable but painful fracture of his lumbar spine. This kept him in bed for a time; he did not find enforced rest easy.

On another occasion, he suffered an injury while skiing. He pulled his hamstring but had a serious complication. He didn't know that he had Paget's disease in this part of his pelvis. He had sustained a pathological fracture of his ischium which avulsed and displaced significantly. A surgical repair failed and was complicated by neuropathic pain in the sciatic nerve distribution. He did not suffer physical weakness but for months had troubling, burning, neuropathic pain. Paragabolin proved helpful, and he gradually recovered. After this event, I remember an AO course in December in Davos, when Maurice was eighty-five years and fully recovered. Maurice, being Maurice, was thrilled to be able to ski on a very icy run at the back of the Parsenn, a ski area in Davos.

The most serious health issue Maurice endured occurred when he developed shingles. The acute, excruciating pain did not lessen in the expected time after the typical rash had gradually receded and cleared after a few weeks. Maurice suffered neuropathic pain, which was so severe that for many months it gave him no peace and greatly interfered with both physical and cognitive activities. After about two or three years, it seemed to be more tolerable and he stopped speaking about it.

As Maurice got older but was, by no means, physically or cognitively failing, he gradually brought his very busy clinical practice to a halt. His pupil Dr Diego Fernandez<sup>1</sup> gradually took over his private practice, but whenever Diego would operate on an old patient who required a difficult revision, Maurice could not resist scrubbing, just to make sure. However, with time he gradually gave up the difficult cases and finally stopped scrubbing altogether. He kept his office and a busy schedule. My project of recording the interviews for this book began in Davos in December 2000 and finally ended in his office in Bern on a summer day in 2004.

“ My project of recording the interviews for this book began in Davos in December 2000 and finally ended in his office [Maurice] in Bern on a summer day in 2004. ” JS

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<sup>1</sup> Diego Fernandez was a surgeon in the department of orthopedic surgery, University of Bern from 1978 to 1982. From 1883 to 1992, he was chief of traumatology of the surgical department in the Canton Hospital of Aarau, Switzerland. In 1991, he became associate professor at the University of Bern and joined the staff of the Lindenhof Hospital in Bern.



At age eighty-six Maurice was still in his office most days of the week, but at the last interview, he complained that his eyesight was beginning to make driving at night difficult. The interviews were not short. They lasted entire days, and we often recorded our sessions for two to three days in a row. Maurice still had boundless energy and would only stop after lunch to take a twenty-minute nap, from which he would arise fresh and eager to continue. At the end of the last interview he admitted that fatigue in the late afternoon was beginning to set in.

All his life Maurice attempted to find a balance between work and his family. He was an avid mountaineer and skier with expert certificates from his army days. He first taught his three children mountaineering and then skiing. All became ski instructors, as did his grandchildren. The family was tightly knit (**Fig 31a**). As he became older and had more time on his hands, the summer hikes and vacations at the chalet became longer. Maurice was never alone. If not surrounded by most of his family, or if not with Marty, he would be with his daughter Janine and her husband Ueli Aebi (**Fig 31b**).

As Maurice grew older the world heaped one award after another on him. He had at least twelve honorary doctorates from various universities. At the age of seventy, he shared the Marcel Benoist Prize for his outstanding achievement in the context of the Swiss Association for the Study of Internal Fixation with his two colleagues Martin Allgöwer and Hans Willenegger. When he was eighty-four Maurice was honored at the SICOT meeting in 2002 in San Diego, California with the title *Orthopaedic Surgeon of the Century* (**Fig 32a–c**).

“ When he was eighty-four Maurice was honored at the SICOT meeting in 2002 in San Diego, California with the title *Orthopaedic Surgeon of the Century* ” JS



**Fig 31a–b**

- a** Maurice with his wife, Marty, and children Denise, Janine, and Jean-Pierre.
- b** Maurice with his daughter Janine and her husband Ueli Aebi.

Maurice was a very generous man by nature; friends, even strangers, could almost always count on his support. He knew the value of money but never had the desire to be wealthy. He would spend his last few francs to buy flowers for his wife. He also knew the evil of money from some of his business dealings. Maurice used the M.E. Müller Foundation to support academic causes in and beyond the borders of Switzerland. He established a daughter foundation in Spain headed by Professor R Orozco. He also established the M.E. Müller Foundation of North America which was headed by Joseph Schatzker for more than twenty years. He made certain that the daughter foundations were sufficiently well endowed to support academic programs. The M.E. Müller Foundation of North America was established in 1984; it still provides educational opportunities for young, promising hip surgeons in North America and Europe. He also established several university chairs and programs at various institutions:

- In 1981, the M.E. Müller chair for biomechanics at the University of Bern with Dr Stephan Perren as the first professor. This was part of the Murtenstrasse 35 project when he set about to establish his “own” university.
- In 1986, the M.E. Müller Institute for Structural Biology at the Biozentrum of the University of Basel with its first two professors: Ueli Aebi and Andreas Engel.
- In 1988, he provided the funds to establish a chair in orthopedic surgery at Harvard Medical School, first held by Dr Wilson C Hayes.
- In 1990, he established a chair of orthopedic surgery in Montreal, Canada at the McGill University School of Medicine, first held by Dr Carroll Laurin.
- In 1992, he established the M.E. Müller Program for Classification and Documentation at the University of Toronto with Dr Joseph Schatzker as its director.



**Fig 32a–c** Maurice attending ceremonies and receiving many awards for a lifetime of achievements.



Maurice extended his generosity beyond the bounds of medicine. In 1967 when he was building his home on the periphery of Bern, he took me to a large field just north of his home, owned by the Martha Müller Foundation. He dreamed that one day he would witness the construction of a “perfectly designed community.” It took many years for this project to materialize. In the early 1980s some residential buildings were erected. Others were to follow in the future. Some years later an opportunity arose that allowed Maurice to endow the city of Bern with a magnificent cultural monument.

On March 28, 1998, when Maurice celebrated his eightieth birthday, a great festivity was held in the Art Museum of Bern. It was by pure coincidence that on this occasion, Marty and Maurice heard about a project to build a museum to display the art of the Swiss painter Paul Klee. The project was foundering due to lack of funding. Maurice had never confided in me that he had an interest in painting. On the other hand, Marty was a devoted supporter of classical music. However, once Marty and Maurice heard that the project was stalled, they made a swift decision. They offered the city of Bern a donation of land and funding to build the museum. Part of the land, owned by the Martha Müller Foundation, which had been set aside for the construction of Maurice’s dream community, was donated as the site of the museum. Maurice funded the construction of the building with money from the sale of Protek that had been deposited in the M.E. Müller Foundation. With this gesture, he felt he was returning the money to the people.

Today, the Zentrum Paul Klee (**Fig 33a–c**) is a permanent cultural testament to the philanthropy of Marty and Maurice Müller. It was designed by the celebrated architect Renzo Piano. As well as displaying the art of Paul Klee, the museum is also an expression of the Müller family’s desire to add other public, cultural facilities, including a concert hall, and a school to teach art for children and young adults.

In November 2008, AO Switzerland celebrated its fiftieth anniversary. The festivities took place in Biel at the Hotel Elite on the shore of lake Biel. Maurice, his immediate family and siblings, and his friends and colleagues were invited. A plaque was unveiled in the hotel to commemorate November 6, 1958, the date and place of the founding of AO Switzerland. This was the last official function Maurice attended. He had lost weight. His piercing blue eyes, which had always been intense and focused, were now darting about. He was confused and seemed to have no idea what was taking place. He had difficulty recognizing his friends and colleagues. It was very painful for us to see this great man in decline.

Maurice died peacefully the next year on May 10, 2009. The funeral service was held in the cathedral of Bern. The church was full of distinguished officials, leaders of the global orthopedic community, family, and friends who came to pay their respects to a man who dedicated his life to understanding the nature of orthopedic fractures and hip disease and to the transformation of their treatment. His efforts have brought relief to millions of patients throughout the world.

“ Today, the Zentrum Paul Klee is a permanent cultural testament to the philanthropy of Marty and Maurice Müller. ” JS

“ His [Maurice] efforts have brought relief to millions of patients throughout the world. ” JS



**Fig 33a-c** The Paul Klee museum in Bern, Switzerland, built on land donated by Marty and Maurice E Müller. Its construction was funded by the M.E. Müller Foundation. © Zentrum Paul Klee





*Afterword*

## Afterword

### Maurice Müller's achievement

Operative treatment of fractures is now accepted as the standard of care throughout the world. Hip replacement has been the single, most important advancement in alleviating the pain and crippling of arthritis. Both developments have had far-reaching socioeconomic impact in saving the lives and restoring mobility for accident victims and for improving the quality of life of the elderly. Maurice Müller was a prime mover in both. Within twenty years from the late 1950s to the 1970s, he developed his principles of osteosynthesis and launched a comprehensive system of fracture care and at the same time, became a leading pioneer, with John Charnley, in the development of total hip replacement.

Like all great surgical innovators, Maurice was a meticulous researcher and a brilliant technician. But he also possessed the rare ability to organize the teaching and dissemination of his principles and build a team of dedicated associates that evolved into an internationally influential organization, the Swiss AO and AO International. His achievements can be explained by his extraordinary set of talents. Maurice was a visionary who could see his goal and plan its execution. He was obsessed with planning and organization in everything he undertook. He was a perfectionist who constantly searched for ways to improve techniques and instruments. He left nothing to chance. He was an entrepreneur, who would take calculated risks to achieve his goal. He was determined to be the best in what he did, and above all, he was an idealist who dedicated his efforts to the benefit of humanity.

Although he acknowledged the role of luck at various stages of his life, Maurice carefully planned the course of his career. Once he had decided to become an orthopedic surgeon, he was determined to innovate and improve patient care. If there were obstacles in his way, he chose not to fight but to veer to a different path that would eventually lead to his goal. Early in his training, Maurice learned that academic institutions were steeped in conservative thinking and unreceptive to innovation. He also saw they could block a surgeon's career path at many stages. Yet, if he found his path obstructed, he would turn the disadvantage into an opportunity. When he could not proceed after his first residency at Balgrist Hospital, he took a job in Ethiopia, where under primitive conditions, he learned to operate quickly, efficiently, and deliberately; it was there that he honed his exceptional technical agility.

Since Maurice knew that it would not be easy to pursue training in orthopedic surgery at Balgrist Hospital, at that time the largest and most prestigious orthopedic institution in Switzerland, he decided to obtain qualifications to ensure that he could not be refused. He planned a tour to visit the most famous orthopedic and trauma surgeons in Europe from whom he could learn up-to-date ideas and techniques; he sought out the best organized hospitals with the largest patient volume. It was during this journey that Maurice discovered the new ideas that set his imagination alight. During his time in Holland with Van Nes, he learned how to organize an operating room, the importance of research, and the advantages of designing one's own instruments. His brief visit with Danis introduced him to compression as the basis of absolute stability and absolute stability as the key to immediate function without plaster fixation. He also took note of the screws and plates Danis had developed to achieve absolute stability. With his gift of seeing

“ Maurice was a meticulous researcher and a brilliant technician. But he also possessed the rare ability to organize the teaching and dissemination of his principles and build a team of dedicated associates that evolved into an internationally influential organization, the Swiss AO and AO International. ” JS



possibilities for improvement, Maurice recognized that Danis failed to disseminate his ideas or demonstrate the proof of his principles because he worked in isolation and did not conduct research or document his work. Many surgeons had visited Danis but it was Maurice who developed the essential steps to adapt Danis' ideas, perfect them, and disseminate them:

- Design your own instruments to facilitate the specific type of surgery you are doing
- Design your own implants with which to execute your method
- Base your method on a set of principles
- Provide evidence through careful documentation
- Support the principles by research
- Nurture a team of supporters to build a school of surgery
- Find a source of funding for research

After completing his visits to European surgeons and finding his path to Balgrist still blocked, Maurice took a position in Fribourg for a year. There he tested his new theories on seventy-five patients with fractures of the tibia. This was possible only in a world which did not demand today's scrutiny of surgical practice, nevertheless, it was courageous. From these results, he formulated his principles of operative treatment of fractures:

- Atraumatic surgery to preserve the viability of bone because only living bone heals.
- Anatomical reduction of the fracture to restore form necessary for normal function.
- Absolutely stable fixation to maintain form and assure union and no pain during postoperative rehabilitation
- Immediate mobilization of the extremity

Maurice's obsession with planning led to documentation. For his first academic qualification as Doctor of Medicine, he hit upon the idea of tracing the outlines of the hip joint in his study of Legg-Perthes disease. This simple form of image documentation allowed a rapid analysis of the cases and laid the ground for his graphic, preoperative-planning method. As he developed his revolutionary principles of osteosynthesis and techniques of operative fixation, Maurice foresaw that he would have to furnish proof that his school of open fracture treatment was superior to conventional methods. Careful documentation would allow him to develop the necessary evidence. Each case was prospectively documented at the time of treatment and at each postoperative visit at six, twelve, twenty-six, and fifty-two weeks. Graphic documentation was carried out with photographs of x-rays, which were later miniaturized. To create accurate, organized records, Maurice designed special forms: A for the first encounter, B for follow-up, and C for complications. The information was recorded on punch cards for sorting, and on them he glued the miniaturized x-ray photographs. At that time, no other surgeon documented his work graphically or in a prospective fashion.

In the early years of the AO in Switzerland, Maurice's radical principles and techniques challenged Swiss trauma and orthopedic surgeons, who threatened to accuse him and his colleagues of malpractice. However, with the evidence he had documented, Maurice was able to provide indisputable proof of the advantages of his method.

“As he developed his revolutionary principles of osteosynthesis and techniques of operative fixation, Maurice foresaw that he would have to furnish proof that his school of open fracture treatment was superior to conventional methods. Careful documentation would allow him to develop the necessary evidence.” JS

Maurice's preoccupation with organization led him to the realization that comprehensive documentation required a system of classification and ultimately evaluation to serve as a basis of evidence-based decision making. To create a data base, whether manually or on a computer, it is necessary to find a means of sorting the case material. He needed a system for classifying all fractures of long bones. Earlier classification systems were regionally based. Maurice sought a much more comprehensive system, which could work for the entire skeleton. The underlying principle of sorting cases was identifying the essence of the severity of the injury, that is the difficulty in treatment and outcome. He developed a system based on triads which was accepted by his colleagues who worked on the SICOT classification committee. Each long bone would have three segments. Each segment would have three principle fracture types: A, B, and C, arranged in order of ascending severity, and each type could be further subdivided into groups. Fractures of two fragments were called simple fractures; multifragmentary fractures had to have an "essence" that separated them into types: wedge fractures were those in which there was contact between the main fragments after reduction; complex fractures were those in which no contact existed between the main fragments after reduction. This system of triads worked not only for the diaphyseal segment but also for the end segments. Maurice's vision was comprehensive. By being the first to establish the fundamental principles of classification, documentation, and evaluation in data and images, he was unquestionably a pioneer of evidence-based medicine long before the concept was invented.

When Maurice visited Robert Danis in 1950, he was perplexed that neither Danis nor those surgeons who visited him had promulgated his theories. When he formulated his principles of operative treatment in Fribourg in 1951, he knew that he was in no position to persuade the surgical world to adopt them. To achieve this, he made careful assessments and plans.

Maurice realized that academic credibility was essential before one would be heard and believed. To that end, he obtained his qualifications as a general surgeon, then as an orthopedic surgeon. In the early days, he gave seminars and lectures to his colleagues. The prize-winning thesis he wrote for his privatdozent on osteotomies of the proximal femur was published as a book in 1957, the first of his many publications. But Maurice also understood that he alone could not prevail against the slow pace and conservative mindset that was prevalent in European universities dominated by powerful professors. To establish a new school of fracture surgery he needed to build a team of supporters. He sought out allies among the chief surgeons practicing in the nonacademic, provincial hospitals. In building this team Maurice recognized that absolute trust among the members was the key and such trust would exist only among those who came from the same canton, sharing similar upbringing, education, participation in sports, university training, and membership in the same fraternities. It was best if they were "Berner."

He was also aware that his surgical methods had to be taught not only in lectures about theory and principles but also in practical sessions. In the first AO course in December 1960, he pioneered a novel method of hands-on teaching of surgery based on simulated fracture models in real bone, which the students fixed with the specially designed implants that surgeons would use in the operating room. This method of surgical instruction has since been adopted as a standard the world over. Maurice considered education as one of the four pillars of his school of surgery—education, documentation, research, instrumentation—but education was always

“ By being the first to establish the fundamental principles of classification, documentation, and evaluation in data and images, he [Maurice] was unquestionably a pioneer of evidence-based medicine long before the concept was invented. ” JS



a tool of information transfer, designed to ensure the understanding of the principles of the method but not as a discipline in itself.

The practical world of hospitals, operating rooms, and the mechanical demands of surgery were also a focus of Maurice's passion for organization. In his first hospital appointment in St Gallen, he worked out a system to utilize the operating room at maximum efficiency to accommodate 900 surgeries per year. After his visit to Van Nes and Danis, where he learned the value of designing one's own surgical instruments, Maurice began to design and modify many implants and instruments. In less than three years, from 1957 to 1960, while engaged full-time in a busy private practice in Zürich and as an itinerant surgeon operating in hospitals throughout Switzerland and abroad, he designed and developed, with his manufacturing partner Robert Mathys whom he met in 1958, the entire AO armamentarium: the newly designed implants for internal fixation and instruments which facilitated their application. These were packaged in the famous, five boxes in different colors to signify their specific use. He recognized that his new method would succeed only if new implants and instruments became available to replace the existing chaos in the operating rooms, where it was common to find a mixture of implants from different manufacturers without any match in sizes or material.

Müller's and the AO's collaboration with Robert Mathys was a remarkable example of a cooperative and productive partnership of surgeons with industry. In December 1960, Müller designed a business model based on a balance of power, which guaranteed that the producers, Mathys and Straumann and later Synthes USA, would look after the manufacture and distribution of their products, while the AO surgeons would be responsible for the design of implants, treatment methods, and their safety. This model functioned well for the first twenty years of the partnership. To ensure that the profit from the sales of the implants and instruments did not benefit any of the AO surgeons directly, Müller drew up an agreement between the AO as licensor and the producers as licensee. The producers paid a royalty based on a percentage of their gross sales in return for the use of the intellectual property of the surgeons, the use of the AO trademark, and the expertise and quality-control guaranteed by the surgeons. All income from royalties flowed into an account used only for the support of research, development, and education. Since the account was under the control of the surgeons, the early AO was fully independent of industry. To receive royalty payments from the producers, the AO needed to own intellectual property. However, it had none. Müller owned all patents on the implants he designed. To rectify this situation, he contributed the patents on all his property, worth many millions, to the Swiss AO. His voluntary contribution set a code of behavior for AO surgeons, who have been expected to follow suit with intellectual property they develop.

Maurice's early accomplishments were neither recognized nor assisted by the academic world. He worked independently or in collaboration with surgical colleagues outside of the universities or in partnership with industrialists. When his surgical accomplishments achieved recognition, he was appointed professor of orthopedics at the University of Bern. Yet it is not surprising that he rebelled almost immediately against the institutional lethargy and academic politics that he saw as inefficient and counter-productive. Frustrated when he was not allowed to organize the university hospital's operating room to run smoothly and productively as in St Gallen, Maurice moved most of his surgical practice to the Lindenhof, a private hospital in Bern, where he was given as much time as he needed. Chafing at interference in

“ *In less than three years, from 1957 to 1960, while engaged full-time in a busy private practice in Zürich and as an itinerant surgeon operating in hospitals throughout Switzerland and abroad, he designed and developed, with his manufacturing partner Robert Mathys whom he met in 1958, the entire AO armamentarium.* ” JS

his plans for teaching orthopedic and trauma surgery to medical students and resenting the time he wasted on academic committees, Maurice created his own university. By lending money to the University of Bern to construct Murtenstrasse 35, a new building, he was able to use it as his base for research until he retired.

Maurice's fame brought him fortune. He understood business and finance but used it to support research and surgical training. He established foundations, university chairs, and research programs. Funding for the AO was based on the royalty payments from the companies that produced the implants and instruments he had designed from his gift of the patents. Money that he made from the sale of hips was deposited in the Müller Foundation that supported his research, documentation, and educational efforts. When he sold Protek, the company that manufactured his hips, he sequestered the money in his foundation to be given back to the people of Switzerland, and near the end of his life, he used it to fund the building of the Zentrum Paul Klee in Bern.

#### Maurice Müller's international influence

Maurice Müller's memory was sharp and clear well into his old age. His story of how he and his colleagues developed operative treatment of fractures and hip reconstruction is immediate and compelling. Of course, Maurice related his story from his perspective; he was not able to assess what ignited the imagination of the surgical world outside of Switzerland. But having had the good fortune to observe the development of the AO from a front seat since 1965, I would like to add some observations about how the surgical world viewed his radical new theories and techniques, especially in the early years.

Maurice's visit to Toronto, when I first met him in 1965, left a buzz of excitement and doubt. Some surgeons traveled to Switzerland to visit him or his colleagues in other AO centers, but their reports were mixed. His technical wizardry turned heads, but most could not absorb all the principles and details of this new school of fracture surgery in brief visits. Thus, some surgeons who had been to Switzerland maintained that the tibia was always plated on the medial side while others, having seen one plating on the lateral side, maintained, with equal emphasis, that this was the rule.

Maurice was very much aware that surgeons needed not only to understand the principles behind his theories but also to see and practice the new surgical techniques that he and his colleagues had developed. From the beginning, the AO held practical courses and pioneered hands-on teaching of internal fixation on fracture models prepared in cadaveric bone.

I held the first North American AO course in Toronto in 1968. With its small audience, composed mostly of residents, the course had little impact. The Swiss AO organized two AO courses in 1969 and in 1972 in Winnipeg, Canada. The faculty was mostly Swiss, although Howard Rosen came from New York to join me and local surgeons from Winnipeg. In the early 1970s, the AO organized a course in Sun Valley. Again, the faculty was mostly Swiss. The number of North American faculty capable of participating was still too small.

Although the educational efforts of the Swiss AO, both in North America and Europe, stirred surgeons' imaginations, few were ready to try the new method. In Europe, progress was more rapid, the result of proximity and lack of language

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barriers. Isolated AO fires began to burn in Germany, Austria, Italy, Spain and France. Some young surgeons were even prepared to take the risk and became exponents of the AO school, but outside of the Swiss AO clinics and the few surgeons scattered around German-speaking Switzerland, Germany, and Austria, and our efforts in North America, progress was slow, even though the AO courses in Davos and sporadic courses held outside of Switzerland were well attended.

In 1967, I had the privilege of doing a fellowship with Professor Müller. With the help of his almost daily tutoring, I translated the first German edition of the AO Manual into English. It was published in 1970. As the first, major publication in English, the manual brought the AO philosophy and method to a much larger audience. Its sales numbered in the tens of thousands.

Upon my return home in 1968, I became a vocal exponent of the AO method. I was fortunate to have Ian Macnab, the late, famous spine surgeon and teacher, as my boss. He did everything possible to facilitate my efforts to reach the world with the AO message, but at the same time he warned me that he was giving me all the rope I needed to hang myself. If the AO method were to fail, so would my career. I lectured on AO philosophy and techniques frequently throughout North America. Surrounded by older conservative surgeons, I often felt like a court jester, but young surgeons who crowded around me after each lecture made me feel that my words were reaching those who would decide the future. In 1971, I was invited by the chairman of the instructional courses of the American Academy of Orthopaedic Surgery to chair an annual course on stable methods of internal fixation, a course which continued for more than twenty-five years. The first year, I was jeered vocally and loudly, but with time, the reception changed. With lectures given everywhere by the growing number of AO pioneers in North America, instructional courses, and many public debates with famous experts of closed treatment, like Augusto Sarmiento and others, the tide slowly began to turn. As our numbers began to grow so did our impact locally, nationally, and internationally. One of the most important developments was the emergence of large trauma centers in Europe and North America, which found the AO principles effective. The challenges of polytrauma patients and their needs for early mobilization to achieve an upright chest as a life-saving measure made internal fixation of fractures a necessity. These centers also provided a concentration of patients which made prospective studies possible.

As the number of AO surgeons grew outside of Switzerland, commitment to the AO school of operative fracture care spread and intensified. Were it not for this growing international support, the school so masterfully led by Maurice and his circle of friends like Martin Allgöwer, Hans Willenegger, Hardi Weber, and others might even have failed. Switzerland simply did not have the critical numbers of patients to provide the volume for prospective outcome studies essential to support AO teachings. The imaginations of young surgeons were ignited not only by images of normal function promised by the new AO techniques in the hands of the Swiss masters but also by personal contact with young, dedicated AO pioneers in North America and other European centers, who had learned the method and could teach its techniques.

The early school of operative fracture surgery as laid down by Maurice and his colleagues was straightforward, but in its early days it was based on dictum rather

than principles backed by evidence. We were taught immediate surgical intervention for any displaced joint and long-bone fracture. However, this instruction of the AO school—to operate early before swelling took place—was nonsense and led to frequent surgical disasters. It took time before we realized that bone was not the only traumatized tissue but also that the soft-tissue envelope was the defining injury, which dictated the time and method of definitive fracture care, and that delay and temporizing techniques were essential to allow the soft-tissue injury to recover before definitive intervention was safe.

In the early years, mistakes were made by following the dictum that early surgery for all fractures was necessary and only absolute stable fixation and primary bone union would offer a good outcome. Yet despite these early errors, the results generally achieved with operative fracture care were so superior that the orthopedic world was forced to recognize a new, undisputed reality—that the time of closed treatment of displaced, articular fractures and major long-bone fractures had come to an end. The new, evolving AO methods were here to stay and would become the accepted standard of surgical care worldwide.

The vigorous pursuit of research in support of this new school began to give rise to a better understanding of bone healing and principles of bone stability. We began to understand that articular fractures and long-bone fractures were different in their biology and biomechanical requirements. With his strain-gauge experiments, Stephan Perren put to rest the concept of obligatory shortening necessary for union to occur and explained why compression could be maintained. His studies with intravital injection, which colored living bone, combined with his studies of undecalcified bone sections and bone under plates, provided an insight into the phenomenon of bone healing under conditions of absolute stability. We learned that internal fixation did not alter how bone healed. Callus was good. Under conditions of absolute stability, bone ends remodeled and the crossing of new Haversian canals welded fragments together, but cortical bone still healed with the formation of callus and cancellous bone by contact.

The advent of locked intramedullary nailing did much to change the early concepts of operative treatment. We began to distinguish absolute and relative stability and under which conditions each was necessary and how each differed in the healing it stimulated. These observations gave rise to the essential concept of bridge plating. Most fractures heal with callus under conditions of relative stability, whereas only articular fractures and simple fractures require absolute stability. We also learned that the type of stability required provided a guide to the type of surgical exposure. Absolute stability required direct exposure and direct reduction, whereas relative stability required an undisturbed zone of bone injury achieved with indirect reduction.

To provide further details would be an attempt to copy a surgical text. The details, however, illustrate how fracture treatment, for the first time in history, began to be guided by principles, not opinions. Fracture surgery became a discipline governed by rules which were based on principles. The elegance of reason guiding treatment inspired a passion for teaching in most rational surgeons. If a surgeon could identify the problem and make the correct diagnosis, he could base his choice of treatment on principles. The AO principles, based on the discoveries of the laws of nature, were then used to guide the correct choice of treatment. The evolution of new implants and new ways of achieving stable coupling of the implant with bone

“*The new, evolving AO methods were here to stay and would become the accepted standard of surgical care worldwide.*” JS

did not change the function of the implant and did not change the laws governing the healing of bone.

Although AO principles were strongly based on the use of implants, the implants represented only the means to realize the principles that supported our methods of treatment. The AO community was also distinguished by its constant quest for a better understanding of the laws of nature that guided bone healing, which led to an ongoing improvement of the surgical treatment of fractures. We were a community of like-minded surgeons. The progress of improving our understanding of what we were doing was intoxicating and inspiring. It generated a cooperative spirit between researchers and practicing surgeons and made us feel that we were not only providing care but also simultaneously contributing to the state of the art of surgical intervention. AO surgeons were proud to belong to an elite community of surgical colleagues, researchers, and manufacturers. This feeling of community effort was so strong that some likened it to a religious fervor. Maurice ignited the initial spark. He provided the impetus that started a surgical revolution which eventually enveloped the orthopedic world. Teaching was our means of promulgating our principles and methods and our tool to dispel ignorance and prevent mistakes. As the numbers of AO-trained surgeons increased, we became a global community.

The thrust to maintain an edge in the discovery of new principles and methods appears to have come to a halt. I believe that we have learned almost all that we can about treating bone with mechanical devices. Our past research was designed to study “how” bone healed. We must now learn “why” bone heals. It is too simplistic to say it heals because it is broken. We must discover the stimuli, the messengers which initiate the cascade of bone healing and learn what are the controls and what modulates this complicated cascade. I believe that this calls for a new approach, for questions other than those which we have posed over the last sixty years. These questions demand a fundamental shift of research away from mechanics and biomechanics and must focus on the molecular level to discover the mystery of why bone heals.

#### Biographical sketch of Joseph Schatzker

Joseph Schatzker studied medicine and trained in orthopedics at the University of Toronto under Professor Ted Dewar. His thesis for a BSc in Medical Science in 1962 was awarded the Starr Medal from the University of Toronto and the Samson Medal from Canadian Orthopaedic Association. After completing a year as the Dewar Fellow in 1966–1967, he visited several orthopedic centers in Europe as a McLaughlin Travelling Fellow, spending longer periods with the anatomist and father of osseointegration Dr Per-Ingvar Brånemark in Gothenburg, Sweden, Professor Maurice E Müller in Switzerland, and Mr Douglas Saville in Edinburgh, Scotland.

During 1968–1985 at the Wellesley Hospital in Toronto, Professor Schatzker published one of the first papers on spinal stenosis. He also published a seminal study on the blood supply of the dens with a proposed a new classification of fractures of the dens. In addition to his clinical work in general orthopedics and surgery of the spinal column, he directed a trauma unit and supervised an animal research facility. His research on the mechanical aspects of internal fixation and bone response to micro-particulate wear-material, conducted with his research partner, the late

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Professor Geoffrey Sumner-Smith DVM, led to the publication of seminal papers on the holding power of screws, the response of bone to movement, and on the biomechanics and histology of the tension band. He also published one of the early papers on pseudomembrane formation and bone lysis in response to microparticle wear of polyethylene.

Professor Schatzker's clinical research led to the publication in 1974 of his classification of fractures of the tibial plateau. His early interest in evidence-based medicine and classification led to his membership of the SICOT presidential committee on classification and documentation and in 1990 to his coauthorship with Professor Maurice E Müller of *The Comprehensive Classification of Fractures of the Long Bones*.

Professor Schatzker has devoted much of his career to teaching the teachers. For twenty-five years, he chaired the American Academy of Orthopaedic Surgeons's instructional course on stable methods of internal fixation of fractures. In 1968, he organized the first AO course in North America, which was held for residents in Toronto. Since 1967 he has been a faculty member at the annual AO courses in Davos and has participated as a faculty member in innumerable AO courses on five continents. His interest in education led to the redesign, with the late Liam Murphy and Jim Kellam, of the early AO course format and to the introduction of the modular AO course format based on principles. From 1997 to 2013, he directed all AOF education in Poland and received the Gruca and Mikulicz medals from the Polish Orthopaedic and Trauma Society and an honorary doctorate from the Jagiellonian University of Krakow. He has published many peer-reviewed papers and with his colleague Dr Marvin Tile, published the best-selling textbook *Rationale of Operative Fracture Care*.<sup>1</sup> He translated the first and second editions of the AO Manual from German to English and edited the translation of the *Rational of Operative Fracture Care* into Polish.

Professor Schatzker is uniquely positioned to have written this biography of Maurice E Müller. He worked closely with Professor Müller from 1965 until 2005, not only on the faculty of the AO fracture courses in Davos from 1969 onward but also as a faculty member of the Bernese courses on total hip replacement under the direction of Professor Müller. In 1972 he became one of the few non-Swiss members of the Swiss AO. From 1984 until 2009, he was president of the M.E. Müller Foundation of North America, served for six years as member of the SICOT committee on Evaluation, Documentation, and Classification, chaired by Professor Maurice E Müller, and from 1992 was the director of the M.E. Müller Program on Documentation and Evaluation at the University of Toronto.

Between 2000 and 2004, Professor Schatzker conducted more than 150 hours of personal interviews with Professor Maurice E Müller. This biography is based on the information gathered during these interviews as well as on his years of collaboration with Professor Müller, which began when he was a student and developed into an academic partnership and a close personal friendship.

Joseph Schatzker is a member of the Order of Canada.

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1 Schatzker Joseph, Tile Marvin. *The Rationale of Operative Fracture Care*. Heidelberg: Springer; 1987.



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.

