ORTHOPÄDIE TECHNIK

Rehabilitation • Medical Products

Orthopaedic Technology from Germany

An export model with a 120-year tradition

by Klaus Dittmer

Special print, official journal of the Bundesinnungsverband für Orthopädie-Technik (the German Association of Orthopaedic Technology)

Orthopaedic Technology from Germany

An export model with a 120-year tradition

History is fascinating, and exhibitions show that history has always been multicultural, not „national uniformity“ but a „development of diversity“. The Botticelli exhibition in the art museum Gemäldegalerie in Berlin (2015/16) showed how new creations stemmed from one idea; and that what was created was passed on again (see DIE ZEIT no. 48 on 16/11/2015, p. 1).

Since its beginnings, the development of orthopaedic technology in Germany has been no different. Initial and further training were very decisive factors that allowed ideas and experience to be developed in order to create products and make them available to those who needed them.

(Fig. 1) Old crest of the guild for orthopaedic technology in Berlin

The economic interests and institutions associated with this development led to the establishment of interest groups, the early guilds and later trade associations (Fig. 1). It was their goal to ensure the quality of the products, training of the next generation, and certification of these tasks by the prevailing government structures. The history of the trade associations, the history of training and state certification formed an important basis that we still benefit from today. However, the process of developing the training structure so that it could become an export model, was long.

To illustrate this process, a few remarks about the persons and events that supported this development - and even made it possible at all - are presented below.

Career change

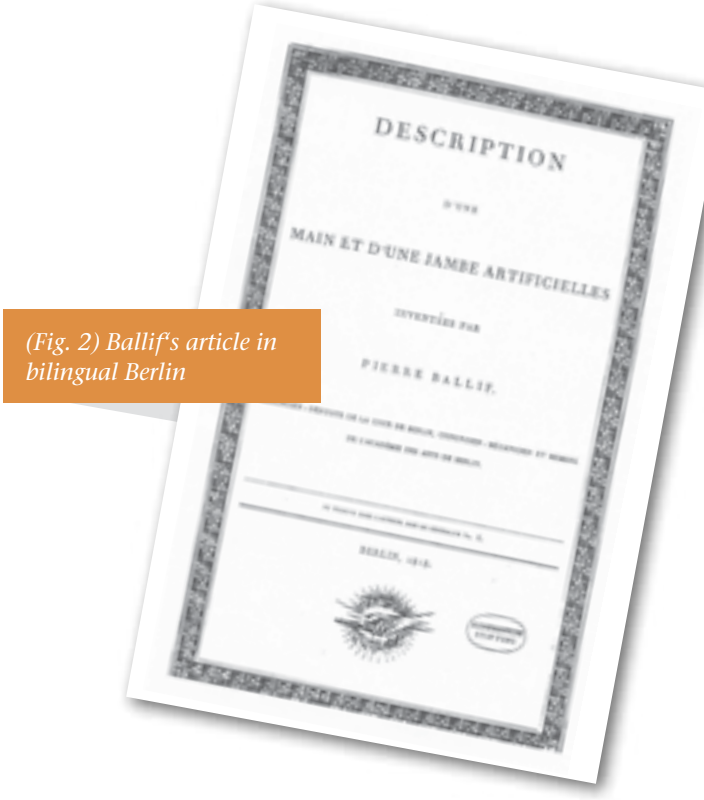
„Surgical brace maker“ and „surgical mechanic“ were job titles that Pierre Ballif (1775–1831), the „court dentist of Berlin“, gave himself. He was the first to describe the design of an arm and a leg prosthesis in detail (Fig. 2) in his article in the then bilingual Berlin: „Description d’une Main et d’une Jambe artificielles inventées par Pierre Ballif“, Berlin 1818. Even 200 years later, it is still relevant.

„I beg critics to forgive my imperfect style and any possible incorrect use of some technical terms. I am always more involved with the things themselves than with the words. I will respect the remarks of real experts and they will be very helpful to me.

I believe I can say without prejudice and without arrogance that I was the first to invent something so simple that is really useful for people. I would owe a debt to humanity if I withheld knowledge from my fellow humans, even if these inventions are not perfect, for perfection is reserved for true artists.

Even if my work is found lacking and judged to be not useful, if other more technically advanced inventions outshine mine, I will always congratulate myself on having directed the attention of more intelligent individuals to something important and having lit a flame in their minds. If it is then seen that I did not bring about real good myself, at least I pointed the way.“

Despite the obvious modesty here, his article did direct interest towards technical orthopaedics.

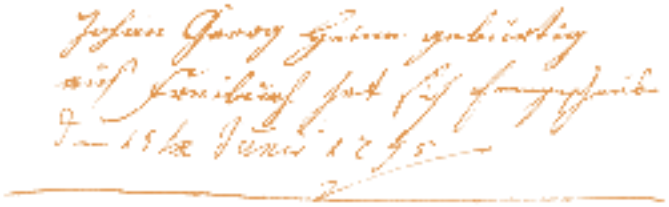


(Fig. 2) Ballif's article in bilingual Berlin

Professional roots

A contemporary of Ballif, who we consider to be a „father figure“ of our profession, and who played an outstanding role in the history of orthopaedic technology, is Johann Georg Heine (1770–1838). Heine, a wandering cutler and surgical instrument maker, reached the capital of Prussia on June 17, 1795 and registered in the journeymen‘s book of the journeymen‘s hostel (Fig. 3).

The obligatory welcome drink, a whole litre of freshly tapped beer, made the rounds in „Willkommen“, a splendid vessel that is now exhibited in the Berlin State Museum. In Berlin, Heine found that good work was associated with recognition and that a journeymen‘s association provided legal and social security (Fig. 4).



(Fig. 3) Heine‘s handwritten registration on his arrival as a journeyman

Heine remained in Berlin for three years, from 1795 to 1798, and later wrote in Würzburg about this period as „experience with the best masters of this time“. There he developed orthoses and mainly treated patients with paralysis and rickets in hospital or in his home.

Napoleon had been leading a war of conquest in Europe since 1803, which led to the subjugation of Prussia in 1806. This defeat led to far-reaching changes, as a result of which the introduction of the freedom of trade act in 1810 changed the structure of crafts and trades in Prussia. Guilds and trade associations lost their privileges and were subject to government control. The state structures created with Stein‘s reforms (statesman Baron vom Stein, 1757–1831) continued to take into consideration the training in the existing guilds and proof of competence for „brace makers and makers of surgical instruments“ that was „similar to that of pharmacists, midwives, etc.“

Career change

It was a woman, Caroline Margarete Eichler (1809–1843), trained by the mechanic Karl Friedrich Eduard Krause, who with her talent for understanding the laws of mechanics and physics, designed and developed prostheses. After the wars of liberation against the Napoleonic occupation, there were many war invalids after 1813 who had had the good luck to survive the torture of amputation, but were now dependent on charity. Caroline Eichler wanted to help them and designed an above-knee prosthesis, i.e. a partially movable artificial foot, a movable knee joint, and a support that allowed the residual limb to guide the prosthesis. Caroline Eichler recognized that residual limb embedding was the key component of a satisfactory prosthesis and recommended wrapping the stump to compensate for fluctuations in volume (Fig. 5).

In an article from 1842, Eichler‘s prosthesis was described as follows.

„If an artificial limb is to meet the justifiable requirements for normal activities of life as far as possible, it must have the following properties:

1.) *Conformity in size and shape with the still existing natural limb on the other side,*

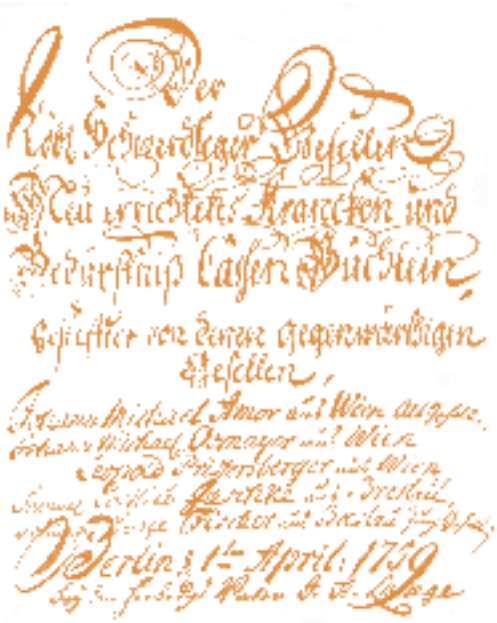
2.) *Low weight and a sturdy material,*

3.) *Easy, comfortable, yet safe attachment to the stump,*

4.) *Lifelike, easy, versatile mobility of joints, the type and extent of which can be modified,*

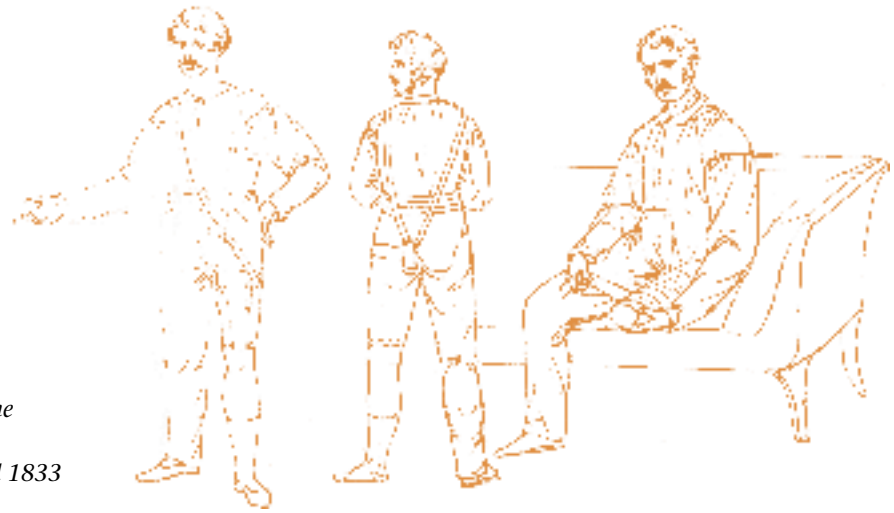
5.) *Simple, reliable and accessible mechanism for movement and Inexpensive with respect to purchase and repairs.“*

Dr. H. E. Fritze: Arthroplastik. Berlin. 1842, p. 5



(Fig. 4) Cover of the „Bedürfniß Carssen Büchlein“ (a welfare fund booklet) of 1 April 1759

”Carssen booklet for the newly established health and welfare fund for chimneysweep journeymen, 1. April 1759“



(Fig. 5) Drawing from the patent specification by Caroline Eichler, around 1833

These requirements showed that Eichler had delved deep into the nature of prostheses and made these demands of her own developments in arm and leg prostheses. She was described as a technical artist and in 1833 was the first woman in Prussia to receive a patent for her inventions. Only ten years later, on September 15, 1843, Eichler was murdered by her former husband Krause.

Historical outline

The companies with a tradition of craftsmanship that were organised in the Berlin guild grew with industrialisation, especially in the field of fabrication of surgical instruments. The companies Windler (est. 1819), Hauptner (est. 1875), C. Müller (est. 1875) and Loewy (est. 1859) are just a few examples of large companies, some with branches in London and St. Petersburg, that also produced orthopaedic devices on a large scale, in addition to medical instruments. The skilled workers required for this were trained on the job or according to the traditional rules of master craftsman training.

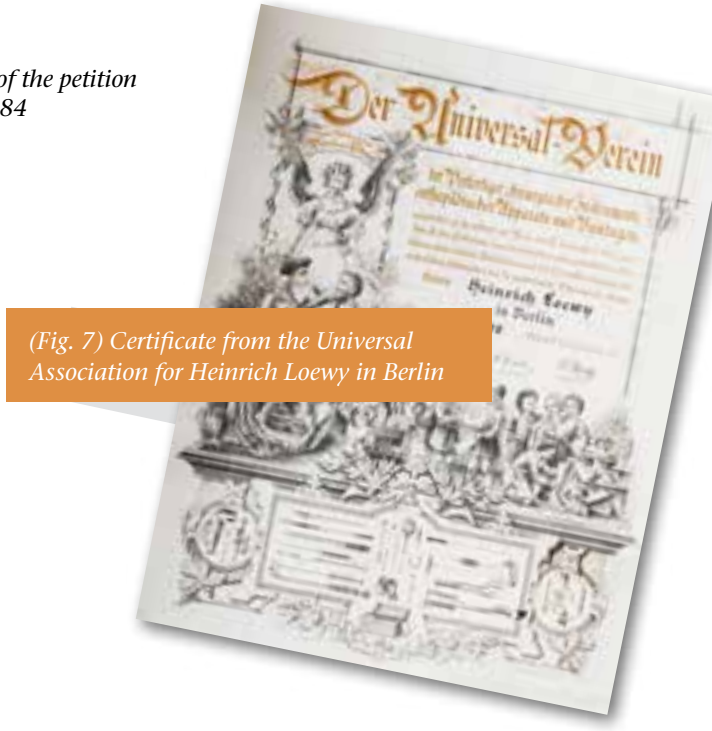

Petition

(Fig. 6) Title of the petition of April 1, 1884

A law passed in Prussia on July 8, 1868 eliminated the requirements for certification for some trades, for example for brace makers and makers of surgical instruments; at that time it was thought that competition would work things out. This resulted in an increase in work – for example due to wandering brace makers – without improving the quality of production. Training, training regulations, and examination requirements for many trades were standardised for the German Empire after 1871 and some regulations were taken over from the North German Confederation, but no change was made to the decisions of 1868 regarding the elimination of examinations for brace makers. The guild in Berlin, strengthened by its member companies and maintaining the professional tradition that was reinforced by the active guild, resolved to reverse the decision to eliminate examinations if possible. Supporters and financial backing were required in order to submit a petition to the Reichstag (Fig. 6).

Rudolf Virchow was one of these supporters, as well as colleagues from Magdeburg, who together with members of the Berlin guild collected 114 gold marks to cover printing costs in order to submit the petition to the Reichstag on April 1, 1884. Unfortunately, I was not able to find the exact response to the petition, but apprenticeship papers from this time indicate the introduction of an examination according to the trade code.

No regulation had been decided on at the national level, but the „Universal Association“ formed a first multinational trade organisation with the following documented


Der Universal-Verein

(Fig. 7) Certificate from the Universal Association for Heinrich Loewy in Berlin

text: „The Universal Association, the maker of surgical instruments, orthopaedic devices and supports, established in Frankfurt am Main on September 12, 1883 with the aim of promoting training and business relations among its members and perfecting technical aids for medical science, acknowledges Mr. Heinrich Loewy in Berlin as an active member of the association“ (Fig. 7).

However, it was the trade protection law of 1897 that first specified the provisions for the apprenticeship system and in 1901, with the support of the Berlin Chamber of Trade, introduced the dual system with practical training in the training company and accompanying classes in vocational school (Handwerkskammer Berlin [ed.]: 100 Jahre Handwerkskammer Berlin. Berlin. 2000). Thirty years of international trade, the exchange of services, and the possibility of practicing trades beyond national borders ended in 1914. Developments in orthopaedic technology and improved production methods became a national challenge during World War I. In 1919, 1120 pages of „Artificial limbs and work aids for war invalids and casualties of accidents“ published by the standing „Exhibition for worker welfare“ and the „Inspection office for artificial limbs“ were published in Charlottenburg in Berlin. The document contained the available data on orthotics, prosthetics and all conceivable aids or devices that could be of use from agricultural to various manual trades. Many developers of hands, feet, and braces were named, but the document did not state who produced the devices and where and how they were trained (Fig. 9).

However, the records from September 27, 1922 of the journeyman examinations of the Berlin guild listed 15 orthopaedic mechanics who had to fabricate either a thigh support or a brace and nine brace makers who passed the test by making a truss, a hernia belt and an orthosis lining. This shows that the desired certification had been regulated by then.

This meant that all the prerequisites for exporting the know-how of brace makers and orthopaedic mechanics had been established.

First examples of „export“

In March 1923, Ernst Lausmann took his journeyman‘s examination as an orthopaedic mechanic by fabricating a wooden prosthesis for the lower leg. Some time later, he travelled – with the help of the German communist party – to the Soviet Union to support an orthopaedic workshop in Leningrad (now St. Petersburg again). After 1939, his presence was no longer desired for political reasons.

Friedrich Lemmer, an orthopaedic mechanic from Lindau on Lake Constance, also accepted an offer from the Rockefeller Foundation to teach at the Beijing Union Medical College in China. With the invasion and occupation by Japanese troops in 1937 and China‘s declaration of war on the German Empire that followed, his work was ended and Lemmer returned to Lindau in 1942. There he developed the „Lindau ankle“, an improvement of the „Berlin Lager“.

(Fig. 8) Photo from a workshop in Berlin, around 1920

(Fig. 9) Excursion with the vocational school, Königs-Wusterhausen, summer of 1921

The harsh atmosphere in the workshop (Fig. 8) was marked at this time by hard physical labour. Splints were forged or merely reshaped, wooden cones were carved or milled; there were no exhaust fans. The finished orthoses were fired and polished on the polishing block and galvanized in the electroplating bath in the workshop. No wonder that beer was always to be found in the workshop.

For customised fabrications of devices in craftsman workshops and larger factories, supply companies sprang up that provided orthotic splints, components for arm and leg prostheses, and special tools as early as 1890. One example is the Carnes hand from the US, which after 1919 was produced in Germany under license. And in the 1922

(Fig. 10) „List of components from Otto Bock“, valid starting November 1941

catalogue of the „German Orthopaedic Works“ and the „Component List from Otto Bock, Orthopaedic Industry in Königsee“ of November 1941, many fabrication and spare parts were offered on 39 pages that made it possible to fabricate prostheses at this time (Fig. 10).

The stamps „no longer available“ on some articles in the catalogue show that there were some supply bottlenecks or an above-average demand for prostheses as a result of German policies.

Orthopaedic mechanics and brace makers were more important at home than on the front, which is why many of them risked going into business on their own after 1945.

Development in Germany after 1945

As in the times of the factories, in 1946–1947, a number of companies arose that also produced components. Some examples of these are the „Drescher knee“ from Göggingen, the „Krauth knee“ from Hamburg, the „Paschold knee“ from Coburg, the „Braun knee“ from Zittau, the „Thiele arm“ from Dresden, and the „Schubje knee“ from Schwerin.

Craftsman and medical-theoretical training was conveyed and discussed to an extent never seen before, and since there was no feeling of competition, the entire focus was on the wellbeing of the patient.

Before the „economic miracle“ took place in Germany, orthopaedic technology was a very busy field due to the number of war amputees, but by no means a prosperous trade.

Until the wall was built in August 1961, orthopaedic technology workshops in West Berlin were paid depending on where patients lived. For a patient from the eastern sector of Berlin, only part was paid in the western currency, the rest in the eastern currency. Employees from the eastern sector of Berlin were paid according to a comparable procedure. When there was an excess of currency from the German Democratic Republic, there was the option of buying at the state-owned OI-VEB Orthopädische Industrie in Königsee. Components for shells from the East and the West were and had to be compatible until 1961.

When the last German prisoners of war returned in 1955, the post-war period was almost forgotten, passports could be had again, and interest grew in German orthopaedic technology and O&P professionals from Germany.

In 1957, the United Nations was looking for an O&P professional to set up workshops in Burma – now Myanmar – and Indonesia. Werner Wille travelled to the Far East with a UN passport and was the first person after 1945 to pass on his expertise (master craftsman examination in Berlin in 1951) on behalf of the United Nations to set up orthopaedic workshops, 1954 in a project on Java in Indonesia, then in Rangoon in Burma (today Myanmar) and in 1957 in a hospital workshop in Manila in the Philippines.


Wo ein „Wille“ ist, ist auch ein Weg

(Fig. 11)
„Der Tag“,
7 February 1957

(Fig. 12) Werner Wille (l)
in the orthopaedic
workshop in Rangoon

On February 7, 1957, „Der Tag“ of Berlin reported under the headline „Where there‘s a „Wille“, there‘s a way“ (Fig. 11), on the orthopaedic mechanic‘s work abroad, describing him as a very talented, worldly colleague who was an inspiration for others (Fig. 12).

The UN's tactic of commissioning German orthopaedic technicians with remedying the consequences of conflicts was probably the reason that this idea was developed further by the Federal Republic of Germany and the German Democratic Republic.

The Hallstein doctrine of the government of West Germany in September 1955 was crucial for this development; it stated „The government of the Federal Republic of Germany may not initiate or maintain international relations with countries that have diplomatic relations with the German Democratic Republic." (except for the USSR) (government declaration on September 29, 1955).

The competition between the two systems – in West Germany under Adenauer and in East Germany under Ulbricht – now became a contest for international diplomatic recognition, even in the countries of the Soviet bloc. As a result of good diplomatic relations or as an extra benefit from establishing new international business ties in each German state, orthopaedic workshops and treatment concepts for export were developed in both parts of Germany.

In West Germany, the GTZ, the German Agency for Technical Cooperation, a state-owned organisation, planned „technical cooperation" in the countries of Africa, Asia, and Latin America. Projects such as orthopaedic workshops for training skilled craftsmen were initiated in a system of learning through hands-on instruction.

(Fig. 13) Sepp Heim (l) and Klaus Dittmer (r) at a patient consultation in Tunisia, 1968

(Fig. 14) Workshop in the military hospital in El Omrane, Tunis, awaiting the arrival of Ger man Foreign Minister Willy Brandt, 1969

(Fig. 15) gtz Lomé, Togo, cover page of the brochure

Examples of „export"

For Tunisia, for example – a popular destination for German tourists – planning was implemented after 1966. Under the guidance of Sepp Heim (Fig. 13) an orthopaedic workshop was established in the old military hospital of El Omrane with the aim of turning trained mechanics into good O&P professionals, leather workers from the state „Artisanate" into brace makers, and local shoemakers into orthopaedic shoemakers (Fig. 14). This project was successful and even years later, my Tunisian colleagues praise the productivity during this period.

The next project was in Togo; the fact that French was an official language in both of these countries made the exchange of local skilled workers easier. Three Togolese had the opportunity to be trained in the workshop in Tunisia and thus helped establish an orthopaedic workshop in Lomé, the capital of Togo.

In 1974, a large orthopaedic technology centre designed by the GTZ and a training centre for orthopaedic technology were established. Once again it was Sepp Heim who led this project to success. The care of leprosy patients was an entirely new field that first had to be developed. The three-year training based on the German curriculum provided the qualification that was to simultaneously be a model for an interregional training facility for some countries in western and central Africa, as stated in a GTZ brochure in 1978 (Fig. 15).

In the same year, on March 16, 1978, the East German Minister of Health handed over a workshop complex for fabricating orthopaedic devices in Ba Vi near Hanoi to the government of communist North Vietnam.

Since 1967, the leading orthopaedic technology company „Orthopädie-Technik Berlin" (OTB) in East Germany, headed by Johann Bayerl, has developed the designs for East Germany's international projects. To implement the projects, a few future employees were invited to undergo training in the East German master craftsman school in Marienstrasse in Berlin. In the 1960s, this training followed the same concept as that in West Germany. While the war in Vietnam was still ongoing (1957–1975), up to ten

(Fig. 16) Housing for technicians at the construction site in Ba Vi, 1973

(Fig. 17) Vietnam1973, arrival of equipment for component fabrication. Klaus Oschatz at work

technicians worked under Klaus Oschatz from Dresden in project development, training, patient care and further and continued training, some of them for several years (Fig. 16 & 17), financed by a „solidarity fund" from East Germany.

After its independence from Portugal in April 1974, Guinea-Bissau was looking for new trade relationships and political supporters. This led to an agreement with East Germany on the establishment of a centre for orthopaedic care. Georg Friedenberger from Rathenow was one of the young master technicians who built up a qualified orthopaedic centre based on his training in Germany. Building material, machinery, and tools were shipped there from Rostock. Setting up and running the projects in the tropical climate required idealism and a great deal of commitment. Friedenberger documented this and the successful training and fabrication with many photos (Fig. 18). Despite the lack of ideological agreement between the two German states, the devices showed no evidence of which part of Germany the know-how and the semi-finished products came from.

A training centre for the East African region was planned in Tanzania as a special project of the GTZ. One hundred years after the end of German colonial rule, the „Tanzania Training Centre for Orthopaedic Technologists (TATCOT)" was established in Moshi in the Kilimanjaro region (Fig. 20). After 1981, the cooperation between the governments of Tanzania and Germany, with the support of the local state churches, resulted in a training and care centre especially for students from the English-speaking countries in Africa. Establishing this centre was Sepp Heim's actual goal, as ensuring the training of specialists for the long term was the only way to at least partially cover the huge orthopaedic technology needs in this country that is twice the size of Germany.

Training and qualification by passing the master technician's examination were the goals of an East German project in Cuba that led to the establishment of what is still the country's most important orthopaedic technology centre. Lutz Kniesche from Potsdam (Fig. 19) developed a training course for the master technician examination that was embedded in Cuba's state training system. This sustainability was a fortunate event for the country that is still suffering from political and economic isolation today.

Based on the East German project in Ba Vi, a new phase of German-Vietnamese cooperation began in 1994. Wilfried Raab (Fig. 21) was one of the leading persons responsible for this. Under his charge many different international organisations helped optimise the orthopaedic technology centre in Vietnam. A few exhibits show devices fabricated in 2014-2015 that demonstrate the wide range of extremely complex devices.

(Fig. 18) Guinea-Bissau; from Georg Friedenberger's photo collection

(Fig. 19) Instructor Lutz Kniesche in the orthopaedic centre in Havana, Cuba

(Fig. 20) At left: Cover page: Diploma Course in Orthopedic Technology Tatcot, Moshi, Tanzania

(Fig. 21) Centre: Photo in the Vietcot article, page 7: Wilfried Raab teaching an anatomy class

(Fig. 22) At right: Cover page: „China Training Centre for Orthopaedic Technologists" CHICOT, Beijing Dong

The „China Training Centre for Orthopaedic Technologists" (Fig. 22) is a superior training centre that is possibly the crowning achievement of Sepp Heim's international work. Established in Wuhan in 1994 and transferred to Beijing in 1997, it features modern German vocational training by German instructors working in partnership with Chinese trainers. A four-year dual training system leads to the ISPO standard after the examination.

A long-term project in El Salvador shows how a training situation based almost solely on manual skills has a great potential for development. Here, the Don Bosco Institute with Heinz Trebbin was instrumental in the development of an e-learning programme that is used today in many countries in Central and South America and could possibly be used even in Germany.

Not all projects of the West German government, supported by the GTZ, later GIZ, were successful. The same applies to East German projects, which were no longer supported after 1989. However, hundreds of O&P professionals from Germany took the opportunity to take a few books and a small tool bag and open doors to new worlds.

These returning development aid workers brought experience and know-how back to Germany that benefited the technical developments in orthopaedics, especially in the orthopaedic technology sector, which smoothed the way for „market access".

It is impossible to name all those who took their technical skills and know-how from Germany to other countries in the past 100 years, sometimes working in difficult climatic and political circumstances. Thanks to them, many injured and disabled individuals in many parts of the world were helped and are still being helped.

Jens Franke (former educator at the Federal Academy of Orthopaedic Technology and employee of the German Association of Orthopaedic Technology) wrote in the spring of 2015: „For me personally, the time I spent as a young development aid worker shaped my world view. I still benefit from that experience. And I also know that the time in Malaysia had an influence on my career and my attitude toward life. The necessary qualifications have certainly increased considerably now, but there is still a huge need for qualified experts.

Well functioning, certified training institutions are not usually available in poorer countries. But around 80 percent of all disabled individuals live in developing countries. We therefore need to help these countries to help themselves.

It is our hope that sufficient funds can be made available to allow an effective contribution to development cooperation to be made in this field.

I would like to appeal to my young colleagues to get similar experience. It is a worthwhile effort – not only for the individuals that you help regain quality of life."

I hope that this historical overview and the corresponding exhibition will direct attention to a thus far little-noted aspect of orthopaedic technology, and I once again quote Pierre Ballif, the first individual who came to this field from another career, „Even if my work is found lacking and judged to be not useful, I will always congratulate myself on having directed the attention of more intelligent individuals to something important and having lit a flame in their minds." (Pierre Ballif, 1775-1831).

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Many thanks to Hannelore Wücke, Berlin, for her editing

Foto: Sabine Stickforth-Siemer

Klaus Dittmer, owner of the medical supply company Ortho-Ped-Dittmer in Berlin until May 2011, is a passionate collector of orthopaedic technology devices. In 2012, Dittmer already put together an impressive exhibition at Orthopädie + Rehatechnik in Leipzig that presented developments in orthotics. In 2014, he presented the exhibition „From wheelchairs to rollators – 150 years of technical history“. In addition, part of his collection is displayed in the Hygiene Museum in Dresden. Some exhibits will soon be added to the medical technology section at the German Museum in Munich.

LEGAL NOTE:

ORTHOPÄDIE TECHNIK:
Official journal of the German Association of Orthopaedic Technology.

ISSN 0340-5591

PUBLISHER:
Verlag Orthopädie-Technik
Postfach 100651, 44006 Dortmund, Germany
Reinoldistrasse 7–9, 44135 Dortmund, Germany
Phone: +49 231 557050-50
Fax: +49 231 557050-70
Email: info@biv-ot.org
Internet: verlag-ot.de

ORTHOPÄDIE TECHNIK

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