

# LÖWENSTEIN medical MAGAZINE



November 2019 Issue

## LM FLOW SERIES

New options in  
High-Flow Therapy.

## 25 YEARS

Löwenstein Medical  
Diagnostics.

## ELISA

Ventilation in the  
21<sup>st</sup> century.

## PATIENT PORTAL

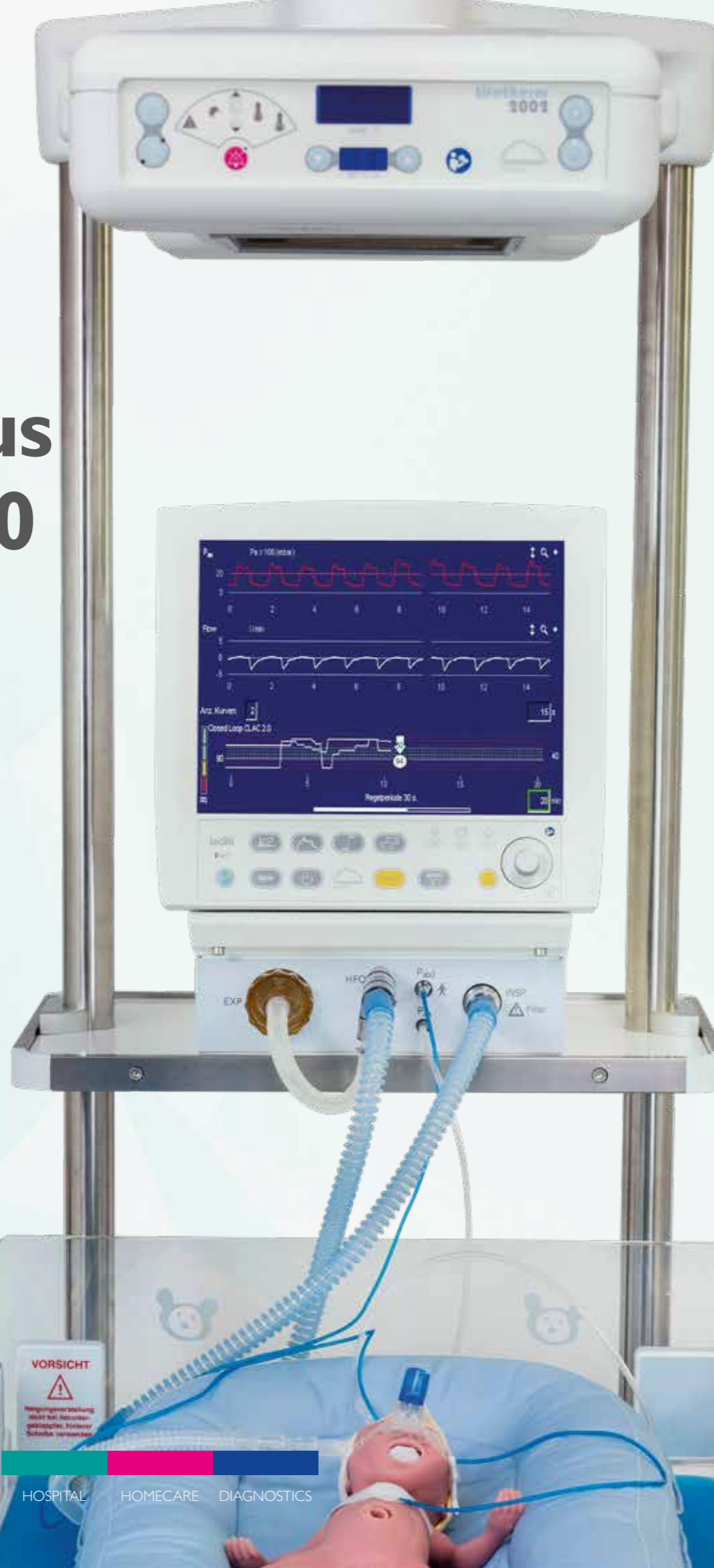
The right offer  
for all patients.

TIPS TO IMPROVE  
THERAPY QUALITY



# Leoni plus CLAC 2.0

Safety you know and trust with optimized control algorithm.



HOSPITAL HOMECARE DIAGNOSTICS

## PREFACE

Dear Customers, Business Partners and Employees,

The health care industry and medical technology in particular have faced many new challenges in recent years. Generally speaking, the changes were to some extent foreseeable and therefore calculable although their manifestation is rarely predictable. That requires a high degree of flexibility in order to handle the changes. Three topics we are dealing with now are the tendering ban affecting Germany, obligatory electrical testing for all medical aids, and the new Medical Device Regulation going into effect next year which will make the registration of medical products more labor-intensive and time-consuming. The last one is troubling because the level of innovation of established market players is not especially high.

Today's technologies which are used extensively in other sectors also offer the medical world unimagined opportunities, but nevertheless remain untapped. Substantial investments are urgently needed in the research and development of medical products.

Other industries are showing how quickly and productively innovation can take hold and radically change our daily lives and work.

The potential is immense if only we can overcome barriers and find ways to harness the technologies for feasible and reliable use in medicine. Because we believe firmly in this potential, we are investing a double-digit percentage of our turnover in the development of new products. This strategy is possible only because the Löwenstein Group adheres to the philosophy of investing its profits in the company. Our investment is ensured by a family foundation.

Not satisfied with that, we also are attempting to make the boundaries between diagnostics and treatment and between in-patient and outpatient applications disappear. The road ahead is long, but who is better equipped to take up the challenge than a family-owned company with a long-term perspective and quick response time? We look forward to hearing from you about your experiences, which we will incorporate in our product development. This magazine gives you a look at what our development centers are working on and what's new in the world of Löwenstein Medical.

Enjoy your reading!

*Benjamin Löwenstein*  
Vice President  
Löwenstein Group

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# SELF-HELP GROUPS VISIT LÖWENSTEIN MEDICAL

Löwenstein Medical welcomes many self-help groups to tours of our sites every year. Our headquarters in Bad Ems combined with our logistics center in Neuhäusel and our homecare manufacturer in Hamburg are the most frequently visited Löwenstein facilities in Germany. This year we hosted many guests from the Self-help Group Ilmenau, the Bavarian regional sleep apnea association and Self-help Group Cloppenburg, Aurich and Delmenhorst, at our development and production site in Hamburg.

Interested participants who had already visited Löwenstein Medical in Bad Ems accepted our managing director's invitation to the production facilities in Hamburg. We surprised the guests with a highly varied program that also included a company presentation and news from sleep therapy, ventilation, patient interface and sleep diagnostics.

In addition to the production of our neonatology devices and anesthesia systems in Bad Ems, the company's other successful segments are in-patient and outpatient ventilation and sleep respiratory therapy.

Our site in Hamburg, with competence in respiratory diagnostics and therapy, develops and produces high-quality medical products "Made in Germany" for worldwide use in sleep medicine and ventilation. On 1 November 2017 after 14 years in Henstedt-Ulzburg, our Production department moved back to our Hamburg premises on Kronsaalsweg. During the tour we conducted, the self-help groups got a close look at the different device lines. Our visitors also were eager to see our highly structured logistics area which was updated and equipped with modern technology for the move in 2017. Amusement was provided by Production's only mobile robot "Giacomo", who independently takes care of stocking the production lines. Time after time the little robot fascinates and amazes our visitors.

And so we wound down an entertaining day at our Hamburg site. Good-bye until the next time! We always look forward to your visits!



Bavarian regional sleep apnea association



Self-help group Ilmenau

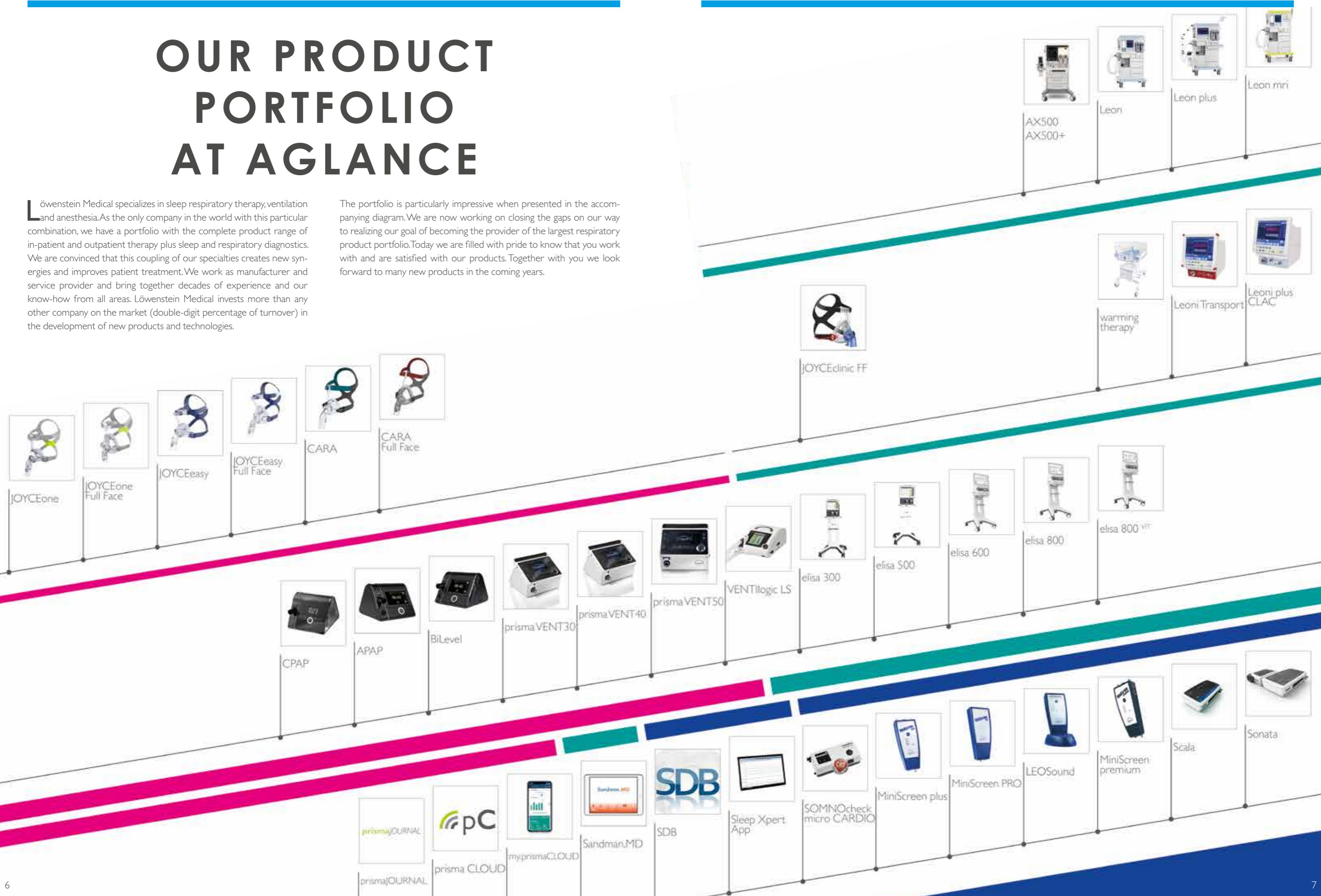


Self-help Group Cloppenburg, Aurich and Delmenhorst

# OUR PRODUCT PORTFOLIO AT A GLANCE

Löwenstein Medical specializes in sleep respiratory therapy, ventilation and anesthesia. As the only company in the world with this particular combination, we have a portfolio with the complete product range of in-patient and outpatient therapy plus sleep and respiratory diagnostics. We are convinced that this coupling of our specialties creates new synergies and improves patient treatment. We work as manufacturer and service provider and bring together decades of experience and our know-how from all areas. Löwenstein Medical invests more than any other company on the market (double-digit percentage of turnover) in the development of new products and technologies.

The portfolio is particularly impressive when presented in the accompanying diagram. We are now working on closing the gaps on our way to realizing our goal of becoming the provider of the largest respiratory product portfolio. Today we are filled with pride to know that you work with and are satisfied with our products. Together with you we look forward to many new products in the coming years.



# DEVELOPMENT SITES

Löwenstein Medical started out more than 30 years ago as a service provider with sales and service of medical products for hospital neonatology departments. Over the years the company developed and entered new business fields, such as sleep diagnostics and homecare for sleep apnea therapy, ventilation and later oxygen medicine. At the end of the 1990s and the beginning of the 2000s, our first in-house developers tested the first design for anesthesia devices. At that time a lot of development was still outsourced, however, we proudly released our first anesthesiology platform and our own ventilator for newborns under the names Leon and Leoni. In the following years the financial potential of our own products was very promising, as was the chance of being able to influence product development, something that had often been left to large global suppliers. Because we were so close to our customers, their needs and wishes could be incorporated in our development. To protect and expand both product portfolio and development competence, Löwenstein Medical long ago acquired an interest in Salvia Medical with headquarters in Kronberg. The company, which now operates under the name Löwenstein Medical Innovation, had established intensive care ventilators in the market and worked as a contract manufacturer for well-known international producers.

It took a few years, until 2015, for the development to pay off and then we launched a series of new and highly innovative intensive care ventilators. There was still another important reason that led the company to become a manufacturer in the homecare field. Pressure from large firms was building, pushing the need for steady increases in sales. Fortunately, the chance came up to become a manufacturer through a major acquisition. Löwenstein Medical took over the struggling Weinmann homecare business unit with sites in Hamburg and Karlsruhe and thereby gained the independence to manufacture its own PAP devices and homecare ventilators. At the start it was not easy to bring the two companies together, but the merger eventually produced a successful duo which conquered the German market first and then the world market.

Over the past 20 years Löwenstein Medical has developed from a pure service provider to an innovative manufacturer in all its business fields and cleverly combined the synergies from direct sales and customer contact with the development of new technologies and products. Today research and development take place at four locations and product manufacturing at four sites. We present the development centers and each one's focus on the following pages.

## LÖWENSTEIN medical, Bad Ems

The development in Bad Ems looks after the existing anesthesia platform Leon and the ventilator for neonates Leoni and right now is developing two new products in this area. Products for both lines and warming beds are manufactured to order on site. Despite its underdog role, Löwenstein Medical secured substantial market share with the help of these products and grew into a renowned manufacturer which today is on equal footing with all its competitors.

Along with the increasing sales figures and entry into new markets, the team in Bad Ems has grown significantly while retaining the qualities it once had as an underdog. Today and then the development in Bad Ems is distinguished by its flexibility, pragmatism and unusual closeness to sales and customers. Based on this success and background, the Development department in Bad Ems has set the goal of not just catching up with competitors in quality and innovation, but overtaking them all.



## LÖWENSTEIN medical technology, Hamburg



Sleep therapy devices, masks and ventilators for the home care business have been developed at the development site in Hamburg since the 1990s. Today about 60 employees work in Research & Development. In addition to the traditional disciplines such as hardware and software design for new product platforms, separate development groups take care of Life Cycle Management, Innovation and Predevelopment. Among our core competencies are professional project management, innovation, design to cost, internationalization of products and, not least of all, our quality consciousness.

We know that modern and efficient development of medical products with real customer benefit requires a solid network throughout the corporate group. Beyond the increasing cooperation among the development sites in Bad Ems, Kronberg, Karlsruhe and Hamburg, we want our product management in Hamburg to have closer contact with our colleagues in Sales. That will bring our development departments closer to the market too.

The team is currently at work on four new products of different types which we expect will win over the world in the coming years.



## LÖWENSTEIN medical innovation, Kronberg

We have been developing and manufacturing medical products in Kronberg in Taunus for more than 60 years. Our innovative technologies develop from the daily info exchange between medical researchers and hospital routines on one side and our engineers' technological know-how on the other. As a forward-looking technology company, we place our stake in full on Germany. Our bundled scientific and technological competence in research, development and production has its roots here. Our focus and with it our core competence in Kronberg is in the devices and software development in anesthesia and intensive care ventilation. We are now investing heavily in development resources and new products in order to achieve technological leadership in both areas in the future. Our team is made up of people of all ages with a variety of qualifications and diverse socio-cultural backgrounds. They are highly engaged employees who put heart and soul into their work.



Ventilation is not just our core competence. It is our world. And we know our way around this world.

## LÖWENSTEIN medical technology, Karlsruhe



In the southwestern city of Karlsruhe we put more than 20 years of experience into the development of technologies for sleep therapy and home ventilation. The core competence at our development site there lies in therapeutic algorithms we optimize continually. Our work is based on cooperative efforts with hospitals and simulation models that our engineers use to test the reaction to defined breathing patterns and fine-tune settings. The software for our home care products too was developed in Karlsruhe.

The developed solutions are used in many different applications such as remote control for therapy settings in the sleep lab, therapy assessments for discussions between doctor and patient, and data analysis and transmission to a secure Web platform. Behind all these products is the broad-based expertise of Löwenstein Medical Technology employees. Their work on digital products today and tomorrow incorporates our knowledge of patient needs for therapy optimization. The speed at which software and algorithms are developing is nothing less than astonishing. It quickens us as we continue to improve the tried-and-tested and take giant steps toward leadership in the global market.

We help you to breathe easily and sleep soundly!

# LÖWENSTEIN ACADEMY – TRAINING FOR THE WHOLE WORLD



What comes after  
the device is sold?



Did you know that every year we welcome visitors from up to 50 countries to our headquarters in Bad Ems?

The steady progress in technological development is making treatment in anesthesiology and ventilation increasingly more complex. That's why it is important to provide users and dealers with well-founded knowledge so they can achieve excellent results with our products Löwenstein Medical in Bad Ems regularly offers training in all products and areas of application. To our dealers we offer customized support suited to their particular needs – on the phone, at their sites, in workshops, lectures or symposiums. The products' complexity also calls for regular maintenance. We also ensure that devices can be repaired quickly by our local partners so that processes in the hospital are not disrupted.

We train clinical specialists and other technicians who are employed in field service by more than 130 partner companies around the world. In special technical training sessions our dealers learn how to carry out maintenance and any necessary repairs to the devices. In application training for users and hospital personnel we explain the devices' functional principles and areas of application.

In our training we tailor both the technical content and intercultural aspects to our customers' specific requirements and show them how to safely handle our devices. We also help them to exploit the potential of the devices completely and effectively. We help them to exploit the potential of the devices completely and effectively.

In response to increased demand, this year alone we have offered product training in anesthesia and ventilation in Bad Ems and have provided other regional training in Malaysia, India, Turkey and Mexico.

We now deliver our devices "Made in Bad Ems" to customers around the world. They are located in Italy, Portugal, Poland, Sweden, Algeria, South Africa, Uganda, Mexico, Ecuador, China, New Zealand and Australia. As the number of installations grows, the subject of training becomes more important in the corporate group. We will certainly welcome many interested, knowledge-seeking customers to Bad Ems again in 2020.

We happily anticipate your visits.

# VENTILATION IN THE 21<sup>ST</sup> CENTURY



## On the way to autonomous ventilation

Personalizing ventilation treatment is both time consuming and labor-intensive. It's necessary to select the appropriate ventilation mode for the current situation, change the parameter settings as needed and monitor measurements continuously. Ventilation has to be adjusted to fluctuating compliance, resistance, respiratory rate and tidal volume.

In clinical practice it is difficult to complete all those tasks as required and desired. So, not unlike the idea of self-driving cars, the wish for autonomous ventilation is now coming from customers looking for assistance.

In an autonomous system the user enters only the target value and the device adjusts the therapy continuously and "autonomously" to the ever-changing situation. As early as 1977 in London the first ventilation process was developed based on microprocessor-managed feedback systems which could keep one or more variables at a constant within a specified range.

In practice, however, the limitations of the first "servo-controlled" ventilation mode quickly became apparent. In a new approach at the beginning of the 1990s, a research team in Mainz hooked up an Apple computer to a ventilator and developed a "Lung Ventilation Controller". That experiment led to a largely automated ventilation and weaning process which became known as "Adaptive Support Ventilation".

### Work of Breathing Optimized Ventilation

WOB (Work of Breathing Optimized Ventilation) combines pressure-controlled BiLevel mode with volume guarantee (= dynamic BiLevel) and pressure-controlled spontaneous breathing mode with volume guarantee (= dynamic PSV). The required expiration time is based on the expiratory time constant and set accordingly to prevent dynamic hyperinflation. The ventilator works to maintain the optimum respiratory rate:tidal volume ratio. It is presumed that the ideal breathing pattern in a spontaneously breathing patient leads to minimum WOB and, under controlled ventilation, to the lowest possible inspiratory pressure applied by the ventilator. Weaning is encouraged by the automatic decrease in pressure support which occurs as soon as the patient's respiratory effort increases. WOB can be combined with an automatic SBT test.



WOB (Work of Breathing Optimized Ventilation) follows the same principle used by the Mainz team. Based on the setting of patient-related and pathophysiological parameters, the ventilator's "closed loop" management continuously monitors and adjusts the ventilation mode and parameter settings to the current situation. Taking into account compliance and resistance, the system readjusts to maintain the ideal ratio of tidal volume to respiratory rate to keep the Work of Breathing at a minimum.

### Rules of „autonomous“ WOB:

- Ensure required minute volume and thus alveolar ventilation
- Supplement ventilation with mandatory breaths as needed
- Ensure mandatory ventilation in cases of low respiratory drive or apnea
- Hand over control to ventilated patient when sufficient respiratory drive is present
- Continuously take into account and evaluate spontaneous breathing activity
- Prevent tachypnea
- Prevent dead space ventilation
- Prevent functional or intrinsic PEEP
- Establish a personalized safety "window" and observe lung protective rules



# Ventilation Mode PAPS

## Proportional Adaptive Pressure Support

The idea of alternative respiratory assistance in which the relation between pressure support and the Work Of Breathing is held constant as opposed to maintaining a fixed level of pressure support was tested by Tyler and Grape in 1962. This type of proportional pressure support makes possible the inspiratory Work of Breathing required to overcome the resistance and elastance of the respiratory system. The Canadian research group headed by Magdy Younes perfected the concept and described the related algorithm in 1992.

In proportional pressure support, a force created by airflow and volume delivery to the lungs (regardless of their source – respiratory muscles, ventilator or both) can overcome the two most important opposing forces:

- restrictive resistance or airway resistance
- elastic resistance or elastance



Advantages of proportional pressure support include averting dyssynchronization between patient and ventilator and preventing erroneous triggering as the ventilator can more effectively adapt support to the current needs of the patient. As the patient's inspiratory effort increases, the ventilator provides more support, giving the patient positive feedback. The low compliance of the lungs is compensated by pressure support which is proportional to inspiratory tidal volume.

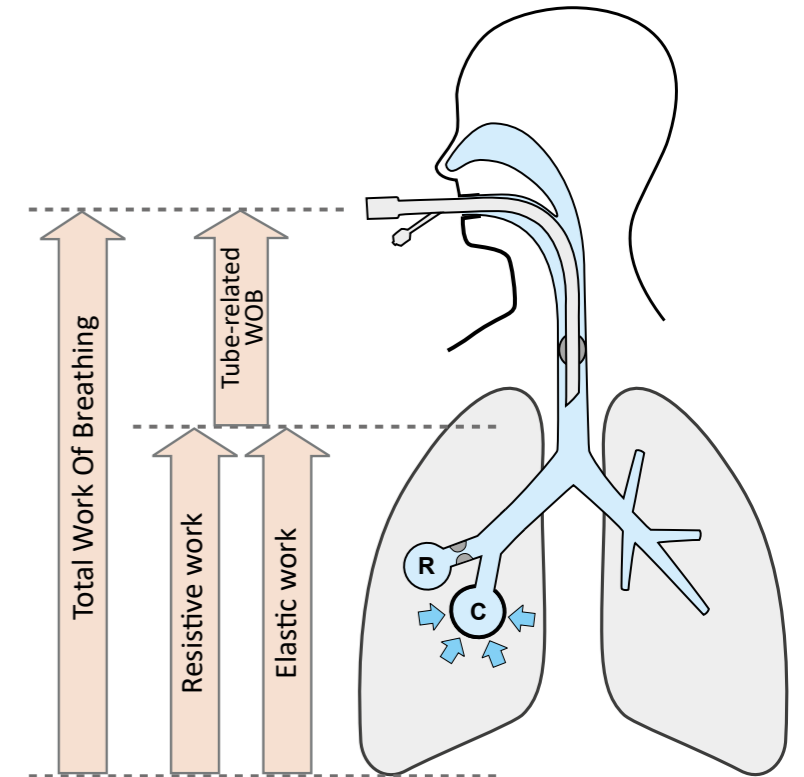
At the same time the increased resistance of the lungs is balanced out by pressure support that increases proportional to flow. The ventilator generates pressure support which, during the patient's inspiratory efforts, is proportional to the delivered flow and volume and thus to the patient's Work of Breathing. Therefore, the extent of pressure support can be adapted specifically to the patient's resistance and elastance.



In the initial models of proportional pressure support, however, ideal adjustment to the respiratory situation of the patient failed. Because the user does not receive valid measurements of compliance and resistance under spontaneous breathing, he/she has to estimate those values. In clinical routines the user was repeatedly confronted by the problem of finding appropriate settings to adequately compensate for airway and elastic resistance. In 2001 the Younes team published a research paper describing a method in which continuous and automatic measurement and preset percentage compensation take place. That work smoothed the way for automatic and continuous adaptation of proportional pressure support to the clinical situation and greatly simplified the settings procedure for the user.

The ventilator automatically calculates the passive respiratory mechanics by performing a series of end-inspiratory plateau maneuvers. The subsequent end-inspiratory measurements ascertain surrogate parameters for compliance. At the same time, resistance and the Work Of Breathing (WOB) are determined continually. The patient's measured WOB lets the user set the degree of compensation for resistance and elastance in such a way that the patient does not have to work harder. That means that exhaustion resulting from increased work by the patient can be prevented.

The PAPS mode makes available proportional pressure support which allows settings to be made easily, provides a greater degree of physiological freedom and makes possible selective compensation for airway resistance and elastance.





# UNIVERSITÄTSKLINIKUM SCHLESWIG-HOLSTEIN RELIES ON ULTRAMODERN VENTILATION TECHNOLOGY

At an Open House on 16 August 2019, the Universitätsklinikum Schleswig-Holstein (UKSH) in Kiel opened the doors to the hospital of the future, which is considered one of the world's most modern medical centers.

The official dedication of the new building, which cost 300 million EUR, took place after seven years of planning and four years of construction. UKSH, which operates on sites in Kiel and Lübeck, consists of 80 individual clinics and institutions, including the clinic for anesthesiology, intensive care, emergency medicine and pain management under the direction of Prof. Dr. Norbert Weiler in Kiel and Prof. Carla Nau in Lübeck.

According to Prof. Dr. Jens Scholz, chairman of UKSH Lübeck and Kiel, the construction project, one of the largest in the world, sets new standards in patient care, research, teaching and the digital healthcare world.



In the construction planning stage, the complete medical technology for the Lübeck and Kiel campus was put out for bids with a total investment volume in the hundreds of millions. The request for bids was staggered and published in lots, including the lot for intensive care and emergency ventilation in 2018. In its application for participation, Löwenstein Medical mentioned our unique product portfolio and comparable reference projects in the EU. Among other things, the UKSH required high-end equipment for all intensive care units with a complete all-rounder concept with regard to innovation, usability, clinical excellence, digitalization, data flow, workflow optimization, modern service concepts and much more. During the negotiation sessions we were able to prove our technological leadership and convince the customer with our system solutions in ventilation technology. With bedside imaging technology integrated in a ventilator and a "walking ICU" concept, UKSH sets standards in intensive care medicine and personalized patient care with the help of our turbine-driven and fully networked intensive care ventilators.

In elisa 800VIT we offer the therapy team the capability of carrying out an electro impedance tomography at bedside and spare the patient a trip to CT, something that often involves logistical difficulties. The "walking ICU" concept is designed to speed up the weaning process in such a way that patients, equipped with mobile, turbine-driven ventilators like elisa 500, can return to full mobilization as soon as possible. After all, the whole point is to improve the outcome of the patient.

These innovations come under the headings of "Big Data" and "networked medical technology". All collected data are stored centrally and processed further for research purposes, transmission of alarms to a distributed alarm system, and connections to digital patient records. We have broken new ground with our elisa@megs (a medical device interface) and are now in a position to satisfy all the above-mentioned requirements with customized solutions.

On 22 August the first patients, including most intensive care patients, were moved into the new building. Although the move presented great challenges to the entire UKSH team and the Löwenstein Medical employees on site, it was successfully completed with the help of everyone involved.

Löwenstein Medical delivered 285 elisa 800 VIT ventilation systems, 50 elisa 500 ventilators, 73 HAMILTON-T1 transport ventilation systems and four HAMILTON-MR1 ventilators which will be used in an MRI setting and elsewhere. For Löwenstein Medical, the project at UKSH is a showpiece which is unparalleled in the world of medical technology. We are looking forward to continuing our cooperation with our customers in Lübeck and Kiel.



„Walking ICU“ concept  
with HAMILTON-T1



LM Flow 100 in hospital application

LM FLOW SERIES

Given the differences in clinical pictures, fields of application and therapy goals, among other things, the equipment required in hospital use differs from that in a home care setting. The synergy from a high-performance humidifier and innovative gas blender technology in the devices LM Flow and LM Flow 100 forms the basis for simple application of High-Flow Therapy with gas mixtures of between two and 80 liters. The oxygen can be drawn directly from a central gas supply system (LM Flow 100) or introduced by means of a low-pressure feed (LM Flow). The large display is used to make therapy settings, keep track of O<sub>2</sub> concentration measured by the integrated ultrasonic sensor, and monitor respiratory gas conditioning. The lightweight and compact design simplifies use in the hospital and in home care and sets a new milestone for hospital and non-hospital application.

A SMALL SELECTION OF SCIENTIFIC FINDINGS

"Improved breathing efficiency relieves the Work Of Breathing in patients with mild cases of COPD."

Bräunlich J, Mauersberger F, Wirtz H. BMC Pulmonary Medicine (2018) 18(1): 14 KL

"High-Flow Therapy increased the end-expiratory volumes and improved oxygenation in hypoxemic patients."

"In normocapnic patients the minute volume decreased without an increase in PaCO<sub>2</sub>."

"The CO<sub>2</sub> flushing was optimized in hypercapnic patients (PaCO<sub>2</sub> reduction with stable minute volume)"

Mauri T, Tumini C et al. Am J Respir Crit Care Med 2017; 195: 1207-15  
Delorme M, Bouchard PA et al. Effects of High-Flow Nasal Cannula on the Work of Breathing in Patients Recovering From Acute Respiratory Failure. Crit Care Med 2017; 45:1981-8

"High-Flow as supplemental therapy with high NIV usage time or intolerance."

Frat JP et al. High-Flow Oxygen through Nasal Cannula in Acute Hypoxemic Respiratory

"Use of high-flow oxygen therapy to stabilize gas exchange in patients undergoing diagnostic bronchoscopy."

La Combe B, Messika J, Labbe V, Razazi K, Maitre B, Sztrymf B, Dreyfuss D, Fartoukh M, Ricard JD. High-flow nasal oxygen for bronchoalveolar lavage in acute respiratory failure patients. The European respiratory journal 2016;47:1283-1286.

"The exacerbation rate in COPD patients decreases with long-term use (of HFT) compared to standard oxygen therapy."

Storgaard LH, Hockey HU et al. Int J Chron Obstruct Pulmon Dis. 2018; 13: 1195-205

"High-Flow Therapy does not hinder the patient from eating normally."

Leder SB, Siner JM, Bizzarro MJ, McGinley BM, Lefton-Greif MA. Oral alimentation in neonatal and adult populations requiring high-flow oxygen via nasal cannula. Dysphagia 2016;31:154-159.

# NEW APPROACHES IN HIGH-FLOW THERAPY

Closing the gaps

Originally used only in pediatric intensive care, High-Flow Therapy (HFT) has since become established in hospitals and home care applications. The range of indications for HFT is increasing all the time. This particular type of breathing support is an important link between Invasive Ventilation (IV), Non-Invasive Ventilation (NIV) and Low-Flow Oxygen Therapy. The effectiveness of HFT comes from the constant flow of air through the nasopharynx which flushes out dead space and reduces re-breathing of a considerable portion of end-tidal CO<sub>2</sub>. Non-invasive and easy-to-use High-Flow Therapy places very few restrictions on patients. During treatment a patient can eat, drink, speak and sleep. Pressure points are unknown. Even delirious or restless patients generally accept this type of treatment. The use of HFT is no longer an exception in diagnostic procedures such as bronchoscopy, as a perioperative supplement in regional anesthesia or in the recovery room.

OPERATING MECHANISMS

In High-Flow Therapy a high flow of heated, humidified inspiratory gas is applied via a nasal cannula. Depending on the indication and place of use, the inspiratory gas may be room air; a mix of air and oxygen or pure oxygen. The effectiveness of this therapy is seen in the flushing of CO<sub>2</sub> from the anatomical dead space with a reduction in respiratory effort, in the enlargement of expiratory lung volume and in stable, high inspiratory oxygen concentration. The flow-dependent formation of a functional PEEP can be disregarded. As the inspiratory gas is heated and humidified, it is possible to optimize secretion management and may be possible to reduce the risk of airway infections.



LM Flow in non-hospital use

"The exacerbation rate in COPD patients decreases with long-term use (of HFT) compared to standard oxygen therapy."

Hernández G, Vaquero C, González P, Subira C, Frutos-Vivar F, Rialp G, Laborda C, Colinas L, Cuenca R, Fernández R. Effect of postextubation high-flow nasal cannula vs conventional oxygen therapy on reintubation in low risk patients: A randomized clinical trial. JAMA. 2016;315:1354-61.

# TIPS TO IMPROVE THERAPY QUALITY

Patient self-care has emerged as one of the most important lines of business for pharmacies. What does "self-care" mean exactly and what does it have to do with Löwenstein Medical?

Self-care involves the purchase of a non-prescription drug, medicine or remedy from the health care industry and medical field. A patient generally buys that type of product on his own without a doctor's order. It may be that the acquired preparation is a pharmacy-only or an Over-the-Counter (OTC) article.

OTC articles, however, have little relevance for the statutory health insurance system because the costs are no longer covered as a result of money-saving measures enacted with healthcare reform in 2003. Nevertheless, OTC articles are effective, safe, economical and therefore a major element in the German healthcare system.

Consequently, self-care has taken on an important role not only in pharmacies but also in our branch offices near you. With our personal, expert advice there and in our online shop, we offer you many OTC articles that increase your quality of life and comfort, particularly where cleaning and hygiene in sleep respiratory therapy are concerned.

The best-known products in the Löwenstein Medical OTC portfolio are our LÖWOSAN special cleaner, our special cleaning brushes, our special descaler and our special cleaning cloths.

We have offered the LÖWOSAN special cleaner in a practical 250-ml bottle for many years. With its improved formula, LÖWOSAN ensures even greater hygienic cleanliness. The effect of cleaning your therapy articles daily with our skin-friendly LÖWOSAN is significantly higher than with conventional cleaning with water. Even so, we recommend that you rinse your articles with clear water after cleaning.

You can gently clean your masks and hoses with the freshly scented cleaner whose perfumes and dyes are biodegradable. Our special cleaner is also kind to the surface of the housing material as it dissolves and removes oily skin residue.

Used together, LÖWOSAN and special cleaning brushes (inside diameter 15 mm or 19 mm) are ideally suited for cleaning the interior of your therapy hose. Our cleaning brushes are a perfect supplement to our hygiene concept. Go to our YouTube channel to watch a video tutorial on the correct way to use them.

We recommend the regular use of our special descaler (now in a 500-ml bottle instead of a 250-ml bottle) for the maintenance of your humidifier. The harder the water is, the more frequently heated humidifiers will develop limescale deposits. Regular use of the descaler gently removes calcium carbonate residue and extends the service life of your device. The special descaler is ideal for all brands of high-quality PAP devices. You'll find the right video tutorial for the descaler too on our YouTube channel.

Our special cleaning cloths, available with a neutral or lemon scent, round off our hygiene portfolio. The practical cloths for daily cleaning come in a dispenser of 64 or a package of 12. You can use them to remove dirt, grease, oils and other organic residues without the use of chemicals.

The benefit from self-care with OTC articles from Löwenstein Medical is that you're able to carry out everyday tasks at home and at work despite mild disorders and health problems and thus maintain your quality of life.



# PATIENT PORTAL: THE RIGHT OFFER FOR ALL PATIENTS

*"HOW CAN I GET HELP QUICKLY WHEN I HAVE A PROBLEM?"*

Nowadays the diagnosis and treatment of Sleep-Disordered Breathing (SDB) follow a clearly defined course. Over the years the process has been repeatedly tested and its effectiveness proven by numerous studies. With any type of treatment, however, one factor is critical. That is, the patient has to accept the treatment and use it correctly. SDB can be successfully treated only if the therapy device, mask and other accessories are used in the right way.

Great similarities can be seen among patients who receive optimal therapy during the course of treatment.

*BED PARTNER IS OFTEN THE FIRST TO SUSPECT A PROBLEM*

The first suspicion usually comes from the bed partner. He or she reports that the person affected snores loudly and irregularly and perhaps even ceases to breathe (apnea). Although the situation may be disquieting, the bed partner might not recognize how serious the problem is. Over time the symptoms become more apparent in daily life. The patient may suffer, for example, from daytime sleepiness, a lack of concentration, headaches or feeling "worn out" upon waking and, despite sufficient sleep duration, may complain of not feeling really refreshed. Though it sounds dramatic, some patients simply accept the situation for a long time or even consider it normal. In some cases, years may go by before the patient consults an expert who can diagnose the problem correctly.



As soon as a doctor suspects a case of SDB, the diagnostics begin. The first step is a polygraphy conducted in the patient's home. He or she wears a measuring device which captures data on respiration and many other parameters. After one night the device is analyzed by the doctor. If the suspicion of SDB is confirmed, the patient is sent to a sleep lab for additional measurements which are more extensive and frequently are made over two nights. Sensors are used to track breathing, movements, snoring, oxygen saturation in blood, ECG and brain waves. All the data are summarized in a hypnogram (sleep profile) which allows an accurate analysis of sleep quality. When the data confirm the finding, therapy is initiated and adapted to the specific needs of the patient. Device, mask, hose and accessories are selected and prescribed so that the patient can continue treatment at home. The patient can obtain the required products from us in one of our branches.

The doctors, sleep lab personnel and the employees in Löwenstein Medical branches are experts in their particular areas. Our patients can be sure that diagnosis, treatment initiation and care will be provided professionally.

*PATIENT EMPOWERMENT IS SUCCESS FACTOR FOR TREATMENT*

For many years our high-quality therapy devices and accessories have stood for the best therapy and greatest comfort. With the use of our medical devices, the symptoms associated with SDB can be completely eliminated in most cases. Many people, however, have a problem accepting the fact that they will depend on a medical aid every night from now on to ensure sound sleep. Although the treatment often helps im-

mediately by eliminating symptoms once and for all, there are patients who have trouble getting used to the mask and the device. Especially in the first phase of treatment, the dropout rate is high.

It is therefore important at this stage to guarantee that patients have solid support in dealing with problems and uncertainties. Later in the course of therapy patients may encounter difficulties and seek help to resolve problems.

*"My mask is not air-tight. What should I do?"*

*"Can I take my device onboard a flight?"*

*"My humidifier is always empty in the morning during winter although I don't do anything different. Am I doing something wrong?"*

*"My wife tells me that I always stop breathing even though I always use my device. Is something wrong?"*

These and many other questions are often asked of us and the treating physicians.



Patients often turn to our branches and Sleep-Respiratory Centers where our employees offer reliable advice and assistance with questions on treatment and devices. Visitors at our branch can use the waiting time to compare notes with other visitors or simply sit and enjoy a cup of coffee in comfortable surroundings.

Even so, we have seen a steadily growing need for information delivered via digital channels. The Internet has developed into an undisputed primary source for medical advice. More than 70 percent of Germans use it first to get help or information about their health or treatment. Our patients are no exception. That's exactly where we would like to become even stronger by improving our digital offering of help with the care and service we provide. Our brand new patient portal delivers high-quality, objective information about treatment with answers to questions such as:

*"How do I prevent the mask from leaking?"*

*"How should I prepare for a trip?"*

*"What can I do to improve my results?"*

*"Are alternative treatments available?"*

*"Can I use a device that's different from the one my health insurer gave me?"*

*DIFFERENT OFFERS FOR DIFFERENT PATIENTS*

We want to provide a digital contact point for all questions regarding sleep therapy in our patient portal where we can present information to our patients in a way that's attractive and easy to understand. The strong Löwenstein Medical brand is trusted and we intend to use that and our information offering to make treatment safer, better and more reliable. The portal is intended to supplement the professional work of our employees in our branches and Sleep-Respiratory Centers, which remains the backbone of our patient care. Those patients who use or want to use the Internet as their primary and easily accessible information source will have an additional digital offer for treatment support. This way we can expand our services and address the wishes and needs of our patients more quickly and effectively.

*WE HELP PATIENTS TO REALIZE THAT THEY NEED HELP*

We won't stop there. Especially in the phase when affected persons do not know what they lack because they have not yet sought medical advice, their own Internet research can yield nothing at all or can lead to spurious offers that have nothing to do with the medical gold standard. It is admittedly not easy to find correct and reliable information among the many sites in the Web. Sometimes patients are led into a spiral of disinformation and disappointment, causing them to delay or, in worst case, to forgo treatment entirely.

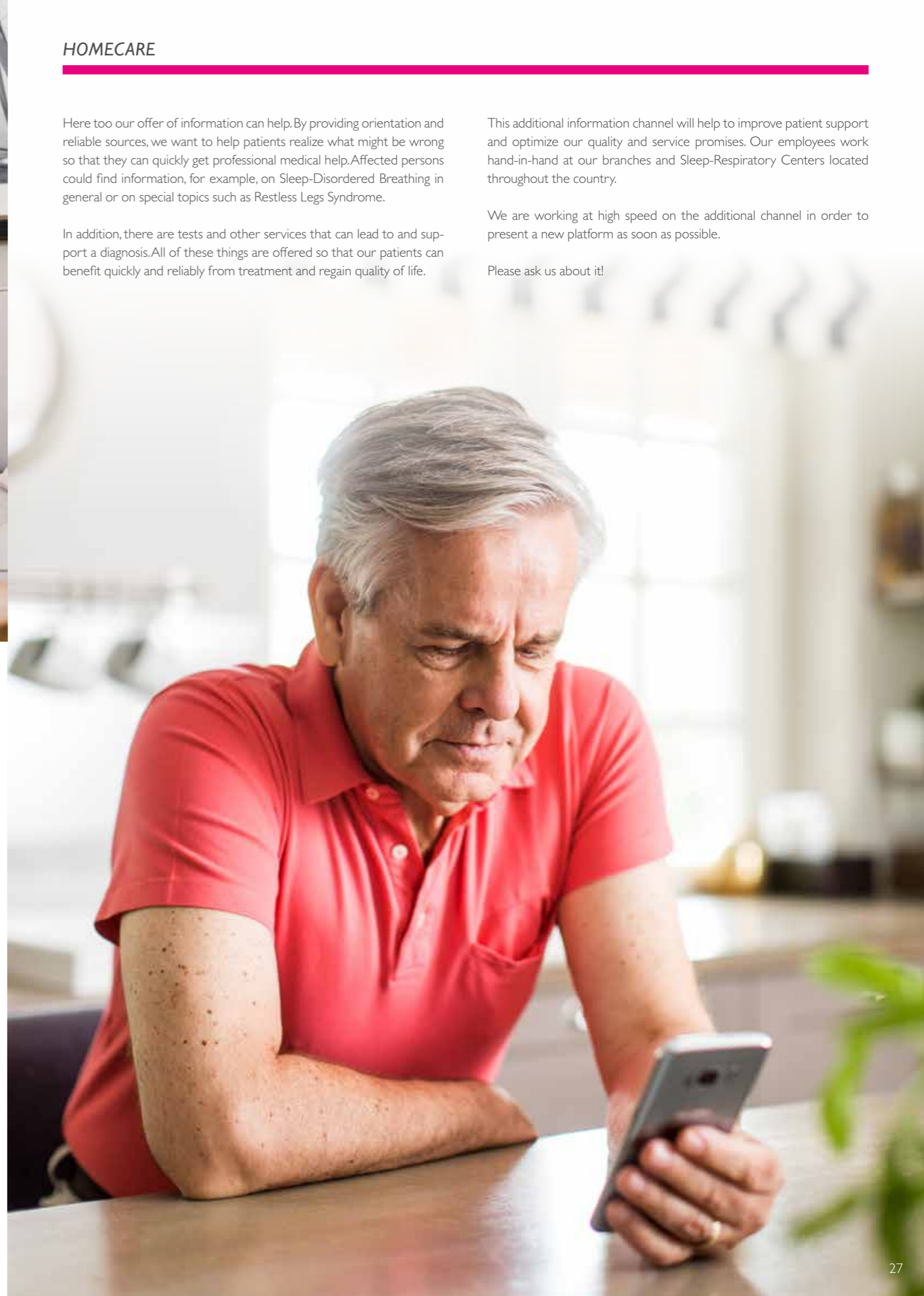
Here too our offer of information can help. By providing orientation and reliable sources, we want to help patients realize what might be wrong so that they can quickly get professional medical help. Affected persons could find information, for example, on Sleep-Disordered Breathing in general or on special topics such as Restless Legs Syndrome.

In addition, there are tests and other services that can lead to and support a diagnosis. All of these things are offered so that our patients can benefit quickly and reliably from treatment and regain quality of life.

This additional information channel will help to improve patient support and optimize our quality and service promises. Our employees work hand-in-hand at our branches and Sleep-Respiratory Centers located throughout the country.

We are working at high speed on the additional channel in order to present a new platform as soon as possible.

Please ask us about it!



# 25 YEARS OF DIAGNOSTICS



Since 1992 Löwenstein Medical has been selling and distributing polysomnography systems in Germany. Twenty-five years ago, in 1994, Heinen + Löwenstein Medizin Elektronik was founded with a focus on sleep diagnostics.

With the most modern PSG systems in the world at the time, the company began its success story parallel to its development into a homecare provider.

Until that time there were only a few PSG systems in research environments that printed mountains of paper which then had to be analyzed manually. A new era began with the first PC-supported polysomnograph systems and the possibility of analyzing data electronically on a computer.

Suddenly sleep diagnostics was no longer limited to scientific and academic institutions, but also could be used for everyday work in pneumology and ENT (Ear, Nose and Throat).

That led to an upturn in the pneumology and pulmonology departments in many hospitals. An increasing number of sleep and respiratory disorders and diagnostics by exclusion could be determined by means of polysomnography and then treated.

Thus the success of sleep diagnostics was and still is directly connected to the development of pneumology and of therapy devices for patient care at home.

As one of the first providers, we benefited from this development and grew to be by far the market leader in sleep diagnostics in Germany.

Because we are close to the market and focused on customer needs, our systems are continuously being improved right up until today. Technical innovations in IT, new technologies for video and therapy connections, requirements of medical societies, and new software products are tested, integrated and updated.

Sleep diagnostics have certainly helped shape our company – in our ideas, customer-specific solutions, our service and training programs.

The complete solutions of an integrated, inter-disciplinary sleep lab of today are no longer comparable in their complexity with the systems from the early days.

Our service infrastructure, quick and unconventional help, great commitment, expert support and solution-oriented action guarantee our success.

Our customers appreciate our service and continuous knowledge transfer. Thousands of employees in sleep labs, doctors and users have acquired their know-how for sleep diagnostics technology in the training programs from Löwenstein Medical. We now operate the seventh generation of polysomnography systems in Germany.

We have changed from dealer to manufacturer and want to offer our diagnostic products around the world in the future.

Filled with optimism, we look forward to expanding the export business where we can certainly contribute to improving the infrastructure for diagnoses in sleep and ventilation in many countries.

## OUR WORK AT LÖWENSTEIN MEDICAL DIAGNOSTICS

We give you a look at our daily work in diagnostics below with interesting facts based on examples of three of our employees. We also introduce our office administration and service technicians working in the office and the field.



### Andreas Fangmann

20 years Service Technician in office-based Support

Andreas Fangmann is one of the senior members working in customer support in the Diagnostics department. This area supports our customers in about 8,000 cases per year when everyday questions, problems or requests for help come up. The support involves the entire range of our fields of activity, from polygraphy and polysomnography products to the operation and installation of software products and support from IT departments with interface setups. Customers from the German market and international customers from all over the world contact us through this department.

### Renard Remschel

15 years Commercial Clerk

Renard Remschel is one of the employees with the longest length of service in office administration. Per year the department processes about 30,000 customer orders and works with our customers to coordinate projects, some 4,000 repairs and loan devices. These employees manage some 3,500 articles in our warehouse which are delivered to 5,000 customers, including practicing physicians and hospital logistics companies. The articles leave our premises in 25,000 packages for which we issue about as many invoices.



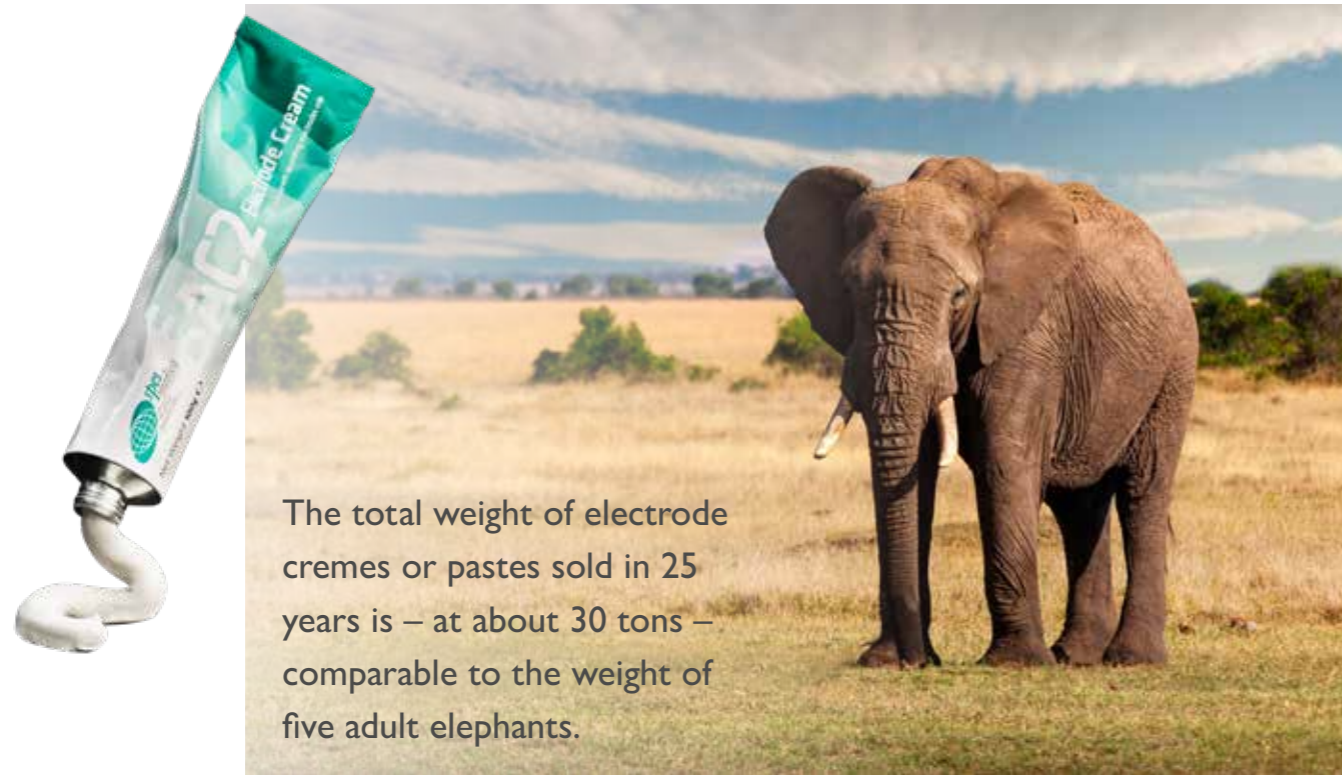
### Stefan Rippel

17 years Service Technician in the field

Stefan Rippel is one of the most experienced employees in technical field service. Our technicians in the field complete about 5,000 service calls and travel on average about 70,000 km per year. They provide technical support to more than 350 sleep labs and more than 3,000 doctors in practices in Germany.

<p>Alice 3 polysomnography</p>	<p>Founding of Heinen + Löwenstein Medizin Elektronik GmbH</p>	<p>First large Alice 3 network system with its own server</p>	<p>Merlin polygraphy</p>	<p>Alice 4 polysomnography</p>	<p>Take over of sales SidasGS</p>	<p>Respironics Stardust 2 polygraphy</p>	<p>EasyScreen 8 polygraphy</p>	<p>Alice 5 polysomnography</p>	<p>MiniScreen 8 BiPAP polygraphy</p>
1992	1994	1995	1997	1998	1999	2002	2004	2005	2006

## Facts and Figures, Dates



**500 years of know-how**

**The average length of service is 11.7 years.**



MiniScreen 12 and MiniScreen 12 BiPAP polygraphy

Take over of today's sleep database



Alice LE polysomnography



MiniScreen plus polygraphy



Alice PDX polygraphy and polysomnography



SOMNOCheck micro Cardio polygraphy



Alice 6 LDe and LDx polysomnography



LEOSound breathing sounds analysis



MiniScreen PRO polysomnography and entry into export



Heinen + Löwenstein Medizin Elektronik is renamed Löwenstein Medical Diagnostics



MiniScreen premium polygraphy



Sonata polysomnography

2007

2008

2009

2012

2015

2017

2018

2019



# HAVE YOU HEARD?

In the category "Have you heard?" we give you interesting information on many different subjects involving the entire Löwenstein Group.



## EMPLOYEES ABROAD

Löwenstein Medical has more than 250 employees at 13 foreign locations. For the most part the international colleagues take care of sales, application and service. Other locations and colleagues will be added in the future.



## 30TH ANNIVERSARY WERNER SEIFERT

Löwenstein Medical congratulates Werner Seifert, authorized signer and Sales Manager Germany, for his 30 years of service. We thank Mr. Seifert for his engagement and loyalty over the years and look forward to continuing our cooperation.

## prisma VENT IN BRAZIL



In 2019 prisma VENT was sold for the first time in a public tender in Brazil.

This year more than 500 systems will be put into operation in the large South American country.



## 20TH ANNIVERSARY UWE GIRMANN



Löwenstein Medical congratulates Uwe Girmann, head of Löwenstein Medical Diagnostics in Bad Ems, for his 20 years of service. We thank Mr. Girmann for his engagement and loyalty over the years and look forward to continuing our cooperation.

## FOUNDATION SAFEGUARDS THE FUTURE

The Löwenstein Group is 100% the property of the Löwenstein Family foundation. That ensures that the corporate group is not for sale and that profits must be reinvested in the company. To secure the long-term existence of the company for our customers and employees.



## HEALTH MANAGEMENT AT LÖWENSTEIN MEDICAL

As part of a regional network for corporate health management, Löwenstein Medical in Bad Ems and Neuhäusel promotes the health of employees with sports courses, health days and discounts at local facilities. In the future the offers will be expanded.



## FAMILY MEMBERS

Altogether four family members – founder Reinhard Löwenstein and all three sons, Sascha (25 years of service), Timo (5 years) and Benjamin (10 years) – work at Löwenstein Medical. The third generation with members from 9 to 14 years old is still too young to join the company.

20TH ANNIVERSARY  
ANDREAS BOSCH

Löwenstein Medical congratulates Andreas Bosch, Sales, for his 20 years of service. We thank Mr. Bosch for his engagement and loyalty over the years and look forward to continuing our cooperation.



NEW SITES 2020

We are investing again in the expansion of our German sites. In 2020 two new buildings will be erected in Berlin Hennigsdorf and in Steinbach im Taunus for two different purposes. The first is a sales and service branch in Berlin/ Brandenburg and the second a modern development and production site for hospital systems.

ELISA GOES AROUND  
THE WORLD

A big order has just rolled in from Indonesia for more than 50 elisa 300 and 50 elisa 500. It's the first big breakthrough in the island nation for our new turbine-driven elisa.



HOMETOWN BAD EMS

With a population of just 9,000, the family's hometown and company headquarters is relatively small, but offers surprisingly lots of culture, including theater, casino, thermal baths, churches and well-preserved historic buildings from the heyday of the spa era. Guided tours with authentically costumed actors show what life was like in the old days. You can still see the hot springs bubbling. For more excitement, you can try out the Canyon Flowline and take a soak in a thermal bath. Along with 10 other spa sites in Europe, Bad Ems has applied for designation as a World Heritage Site. A decision is expected in 2020.



prisma CLOUD



TELEHEALTH  
Simple. Flexible. Reliable.



prisma SMART



prismaLINE



prisma VENT



HOSPITAL HOMECARE DIAGNOSTICS



bad ems  
GERMANY



kronberg  
GERMANY



hamburg  
GERMANY



rødovre  
DENMARK



salzburg  
AUSTRIA



vienna  
AUSTRIA



neuenhof  
SWITZERLAND



igny  
FRANCE



barneveld  
NETHERLANDS



bracknell  
ENGLAND



shanghai  
CHINA



lod  
ISRAEL



istanbul  
TURKEY



wettenberg  
GERMANY

