Back to Life
The fine art of trauma surgery
It’s a Riddle!

Quality is a matter of details, and at Dräger you'll find top quality in every product—including the roughly 250 gas detection tubes. But how many different gases can they identify? You'll find some hints starting on page 16.

1. 250+
2. About 500
3. Over 1,500

Send us the correct answer via e-mail to draegerreview@draeger.com or on a postcard to our editorial address (you’ll find it on page 22), and you may win two of a total of 50 ballpoint pens modeled on Dräger gas detection tubes.

The deadline for entries is July 31, 2010. Winners will be notified in writing, so please indicate your name and address. Prizes cannot be paid in cash. Dräger employees are not entitled to participate. Participants hereby waive all legal rights to enforce any award.
26 special containers 

house the naval hospital on the 
Task Force Support Ship Frankfurt am Main. Read more starting on page 14.

**EXPERIENCE**
4 People Who Perform Training for air rescue operations in Germany; screening for drug users in Spain.

**NEWS**

**FOCUS**
8 Routine Surprises Trauma surgery often involves life-and-death struggles, critical injuries, and extreme time pressure.

**REPORT**
14 Hospital on the High Seas From an ectopic pregnancy to third-degree burns—naval physicians have to be ready for anything.

**INSIGHT**
16 Where Gases Show Their Colors Dräger tubes analyze invisible dangers.

**OUTLOOK**
20 Headshaking in the Operating Room Gesture-based systems for controlling technical devices reach hospitals.

**SERVICE**
22 Where and Who? Dräger worldwide; publishing information.

**CLOSE-UP**
24 High-frequency Ejector The Babylog VN500 makes it possible to utilize a broad range of therapies for premature babies. One important component is the expiratory valve.
What Moves Us—Dräger Worldwide

Marco Monnig, specialist nurse and paramedic at the ADAC Air Rescue division, Munich / Germany

“It’s a good feeling when you see the child is alive—and watch it leave the hospital with its parents! I have experienced heart-pounding responses for newborn babies a number of times, and it has affected me. A rapid treatment, at the right moment, means the difference between life and death. If it works, the patient is rescued. That’s our objective!

There’s little room for error. The right equipment and knowledge need to be deployed at the right place. Our tool is the helicopter. But a tool is only as good as the hands that guide it. And to insure that they’re the best, we provide intensive training. My colleagues have come here from all over to be trained. And we train to act as a team—the seamless coordination of all involved is crucial on board. ‘ChristophSim,’ our training tool made of wood, is in Hangelar near Bonn. It’s constructed as an exact replica of its flying counterparts: perfusors, monitors, an Oxylog 3000, and little space. The SimMan, our patient, is true-to-life. He can actualize bodily functions, be auscultated and ventilated.

It’s also vitally important to be able to plan ahead under stress. Anyone here who is trained in air rescue knows: “I can’t just pull over and stop on the shoulder of the road if something hasn’t been correctly thought through.” Once in the air, we already need to have an overview of what we’re doing. Does ‘ChristophSim’ really work? Time and again we knock on his side door to say: ‘Welcome to the hospital. You’ve landed’—that’s how gripping the simulation is.”
Francisco Javier Rodríguez-Madridejos Jiménez, Police Chief of Seseña, Castilla-La Mancha / Spain

"Until two years ago we had no equipment for doing drug tests. We simply had to let suspects go, and it was really frustrating not to be able to take any action. It’s true that we always caught drunken drivers during our traffic checks, but the issue of drivers on drugs was left completely open. That ate away at my professional pride: we were sending time bombs on wheels back out onto the streets. Things just couldn’t go on that way.

Our community, Seseña, is located in the north of Castilla-La Mancha and has less than 20,000 inhabitants. Madrid is not far away, so we have a lot of through traffic.

Two years ago I initiated the project ‘No drugs at the wheel!’. We bought a reliable mobile drugs of abuse detection system from Dräger – and now we can finally conduct comprehensive and effective drug screening.

The results have been amazing: Sometimes we catch eight drivers on drugs for every one drunken driver. But drug users’ attitudes are slowly changing.

When we confront them with the test results, they’re astonished and incredulous. They no longer have any excuses. Many of them then tell us about their worries and problems, and we listen to them with a psychologist’s sensitivity in order to find out what factors are influencing their condition. Mostly these are people of a certain age, about 40, and the drug is mostly cocaine. A 20-year-old who smokes marijuana reacts differently. In 97 percent of the cases, these people pay the fine immediately. We also have the feeling that they realize how efficient the police force is and that they have a bad conscience because of their consumption of illegal substances."
Dräger HPS 3100 Universal Helmet

The Dräger HPS 3100 multifunctional universal helmet is ideal for challenging assignments in the field, such as forest fires, traffic accidents or mountain rescue missions. It combines optimal protective functions, thanks to the integrated polystyrol inner shell, and is very comfortable as a result of features such as the four-point harness and padding throughout the entire head area. An adjustment wheel lets the helmet fit individual head sizes. The ventilation system ensures a comfortable temperature and humidity level inside the helmet, even during long periods of forest firefighting. A metal lattice keeps out large debris particles, and the ventilation system can be closed with a simple slide control to protect the wearer from smoke or extinguishing water. The modern design and structure of the HPS 3100 make it a combination of an industrial safety helmet according to EN 397 and a mountain-eer helmet according to EN 12492. The entire inner suspension ring and the neck curtain are padded. A comprehensive range of accessories, including an electric visor, optimizes the helmet for a multitude of special applications. The market launch is planned for the third quarter of 2010.

A New Emergency Ambulance for Preterm Infants

About 700,000 babies are born in Germany every year. Some 30,000 of them have to be transferred from children’s and maternity hospitals to special clinics, either because they are preterm infants or because a child with a normal birth develops life-threatening complications. Transporting these babies calls for specially equipped emergency ambulances, and the Bjorn Steiger Foundation has been developing them since 1974. The latest model is scheduled to be inaugurated in the second half of the year. “Neonatologists are already calling it a quantum leap,” says Melanie Storch, who works at the foundation. It cost about one million euros to develop the prototype, and the foundation intends to finance 100 of these ambulances by 2014 at a unit price of about 200,000 euros.

The centerpiece of the emergency ambulance for babies is the crosswise transport incubator. “In newborn babies the fontanelles in the skull have not yet closed,” Storch explains. “That’s why the babies have to lie crosswise to the direction of movement so they won’t be affected by the acceleration and deceleration during the drive.” However, this kind of crosswise transport is not possible in conventional ambulances. In addition, the newly developed model is equipped with an innovative active damping system that significantly reduces shocks and vibrations. An electric motor and pneumatic springs are capable of cushioning even the impact of ten-centimeter-deep potholes. Dräger will provide almost all of the vehicle’s medical technology equipment. This includes the transport incubator system, which was developed in cooperation with neonatologists, nurses, and midwives, as well as an international team of medical technicians. The central gas supply equipment, respirators, and monitoring systems also come from Dräger. In addition, acoustics specialists at the Dräger test center are working on the sound insulation inside the emergency ambulance for babies.
Italy: First SmartPilot View

The history of the Ospedale Maggiore began in 1351. Today the 638-bed hospital, which is located about 50 kilometers southeast of Milan, serves about 150,000 residents in the surrounding region. It recently acquired two new Zeus Infinity Empowered anesthesia systems – including a SmartPilot View. “That makes this hospital the first one worldwide that can monitor the anesthesia stage with the help of our smart display,” says Emilio Car-mignotto of the Dräger sales team. Dr. Agostino Dossena, Director of Anesthesia at the Ospedale Maggiore, chose the anesthesia systems first, and was then impressed by the sophisticated monitoring technology.

The SmartPilot View supports the anesthesiologist in the operating room from the initial administration of the anesthesia all the way to the wake-up phase. All of the important data – including a forecast of the course of the anesthesia – is graphically depicted on a large display.

A Dräger Website for 48 Countries

The slogan “One Dräger – One Voice” now also applies to the Internet. Thanks to a recent innovation, the company’s website now automatically registers the country from which it is being accessed and then redirects the user to the corresponding local website. This feature now applies to 48 countries and 29 languages.

All of the websites offer general information about the company as well as information and fascinating 360° views of Dräger products, videos, and product demonstrations. Visitors can find out more about the company and its product range by clicking on links such as “Products & Services,” “Careers,” “Investor Relations,” “Press Center.” You can find an overview of the contents of Dräger Review in the “About Dräger” section. www.draeger.com

Dräger Review in German, English, and Spanish

Ever since its first issue in the summer of 1912, Dräger Review has informed its readers about the company’s technological products and their applications. The first issue in English, which was published in 1959, featured the use of compressed-air breathing equipment in the mining industry and firefighting. This issue of the magazine is the 385th published in German and the 100th published in English.

“This is our demonstration that we speak our customers’ language, not just metaphorically but also literally,” says Burkard Dillig with a smile. Dillig, who is currently Dräger’s press spokesman, was responsible for Dräger Review for over 20 years until the end of 2007. In this, its 99th year, the magazine is launching an additional edition in Spanish, which is soon to be followed by one in French. By taking these steps, the company is responding to the growing significance of the markets where these global languages are spoken.

“We feel the same way about Dräger Review as we do about our products,” says Stefan Dräger, CEO of Drägerwerk Verwaltungs AG. “Everything we produce should provide our customers with maximum utility.”

Since the end of 2008, the new design has been accompanied by technical information and local reports that are appreciated by many readers. Today, three issues of Dräger Review in two versions – one for each corporate division – are published annually. It has a total circulation of over 80,000 copies.
Routine Surprises

Every medical specialty has its own particular challenges. In TRAUMA SURGERY several elements come together: the life-and-death struggle, critical and diverse injuries, and extreme time pressure.

Dr. Gerrit Matthes has just gone off duty following a grueling 20-hour shift. However, under the circumstances he still appears wide awake and surprisingly fresh. A trauma surgeon, he runs the emergency room at Unfallkrankenhaus Berlin (UKB) and has just performed two emergency surgeries. First, a 14-year-old boy was brought to the hospital, which is located in the eastern section of Berlin, by his father during the night. The ambitious young soccer player had been tackled hard by an opponent and suffered a broken lower leg. "He was in severe pain, and that alone is reason enough to go ahead and operate during the night," says Matthes. The senior physician had to choose the treatment method very carefully. That's because bone growth is not yet completed at age 14 and can be disrupted by a fracture. Dr. Matthes opted for a method developed by Prevot. To spare the bone's growth plates, Matthes inserted elastic nails into the marrow cavity of the shin via a small incision in the leg.

The "Christoph Berlin" ensures that patients in rural regions are also able to take advantage of the city's high-tech medicine. The Bell 412 critical care transport helicopter stationed at the Unfallkrankenhaus Berlin is on call 24 hours a day and is crewed by two pilots, an emergency physician, and a paramedic. The helicopter can, for example, carry an infarction patient together with an intra-aortic balloon pump, which it can supply with electricity. It can now even transport heart-lung systems. As a result, the "Christoph Berlin" not only flies to accident sites in Berlin and Brandenburg, but also transports patients from smaller hospitals to specialized medical centers.

Touching down: The crew of the "Christoph Berlin" critical care transport helicopter from Unfallkrankenhaus Berlin has landed.
Routine Surprises

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The skin. No cast is required following the procedure. After a few months he will remove the nails, once again via a small incision in the skin. After treating the boy, the doctor and his team operated on an 80-year-old woman who had fallen during the night and fractured her thigh near the hip joint.

A finger on the pulse of time

It’s all just another night, as far as Matthes is concerned. And despite the length of the shift he has just performed, the dedicated trauma surgeon remains enthusiastic about his specialty area and his hospital. “Sure, the workload is very heavy here, but that gives us a great opportunity to improve things. Medicine is an experience-driven science, and we see a very large number of cases in a very short period of time,” he says.

Unfallkrankenhaus Berlin was designed and built to focus on accidents and emergencies, and according to Matthes it offers ideal conditions for trauma surgeons. “The cooperation here is extremely smooth. We have the latest equipment and work more or less with a finger on the pulse of time.” State-of-the-art equipment and team spirit help ukb live up to its high expectations. The trauma center is considered one of the most modern in Europe.

A flying intensive care unit

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IN BRIEF

Doctors and nursing staff face extraordinary challenges at a trauma center—not just professional challenges but physical and mental ones as well. The need for quick action according to algorithms should not become an obstacle to new methods. It’s also important to institutionalize this flexibility and have a viable business concept.

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From hangar to operating room

The ultramodern character of the place is immediately obvious on the roof, where a red-and-white wind sock waves atop the four-story building of light brown bricks. This is where the rescue and critical care transport helicopter “Christoph Berlin” lands and is then immediately transported on rails into a glass-enclosed, temperature-controlled hangar. In emergency medicine, even short distances can mean the difference between life and death.

For this reason, an elevator leads directly from the hangar to the centerpiece of the trauma center: the trauma room for the seriously injured. Directly adjacent is the massive apparatus of a 64-line spiral CT, one of the hospital’s technological highlights. The patient’s entire body...
A world without germs

A second elevator leads from the helipad on the roof to a second trauma room designed especially for burn victims. It is the gateway to a germ-free world maintained at a constant temperature of 40 degrees Celsius. In the event of severe burns, the patient is first placed into a large tub where the burned skin is scrubbed away from the patient’s body using steel brushes. Even deep burns covering more than 80 percent of the body surface have already been successfully treated at ukb. In case such as this, synthetic skin is cultivated in a ukb laboratory if the amount of the patient’s own remaining skin is insufficient.

The critical hour

The narrow time interval between an accident and life-saving measures is referred to as the “golden hour of shock.” “It is always underestimated, because the clock starts ticking immediately after the accident, long before emergency personnel arrive,” warns trauma surgeon Dr. Gerrit Matthes. Although deploying a helicopter at a cost of 1,143 euros per trip is significantly more expensive in Berlin than deploying an emergency physician’s vehicle (700 euros), it can prove to be more cost-effective in the end. “Under certain circumstances, a few minutes of acute care can save many days in the intensive care unit,” says emergency physician Dr. Jörg Beneker.

Other countries, other traumas

In the meantime, many other countries are interested in the ukb’s expertise. Witt has just returned from a consulting trip to Brazil, where some facilities are also specializing in trauma medicine. “There’s no air rescue service there, and the streets are often in poor condition,” reports Witt. The types of trauma encountered vary greatly from region to region. In rural areas, surgeons often treat cuts suffered by farm workers. In the city, on the other hand, they are confronted with a large number of head injuries, in part because Brazilians often ride their motorcycles without helmets. “The technical equipment there is completely different than it is here, but everyone has national health insurance that pays in full for all services,” adds Witt.

Up to now the situation in the U.S., where ukb also maintains partnerships, has been very different. A trauma cen-
Within minutes, a helicopter lands on the hospital’s helipad. Its door swings open, and a ramp descends. In the trauma surgery department, they call it the ‘lucky bus’—because, within 15 minutes, it brings severely injured people directly to the hospital’s emergency room. At the University Hospital Berlin (UKB), each year approximately 50,000 severely injured people are treated. Patients are transferred from throughout Germany and up to 1,500 patients arrive each year from abroad. Dr. Peter Witt is an emergency physician and director of the university’s institute for trauma surgery. He has been involved in the planning of the hospital since its inception in 1997. Back then, the hospital’s annual budget was 27 million euros, and the target was to avoid making any losses. "That was our goal," says Witt. "We expected to be run economically." He speaks of the hospital’s success in terms of the number of emergency patients, but also in terms of its financial performance. Since the hospital’s opening, it has consistently achieved a balance of 5 million euros per year. Even in 2009, the first year following the worldwide financial crisis, the hospital managed to achieve a profit of 4.1 million euros. The reasons for this success are clear, and can be traced back to the hospital’s location in the capital city of Berlin. The UKB is located in the central part of the city, close to major freeways and major airports. This location allows the hospital to quickly and easily access patients from throughout Europe. "We are at the heart of the German capital," says Witt. "This means that we have access to all of Germany." The hospital has a long tradition of treating injured soldiers from the Second World War, and it also has a strong tradition of treating injured soldiers from the Cold War. Today, the hospital serves as a center for the treatment of injured soldiers from conflicts throughout the world. Witt is proud of the hospital’s ability to serve the military, and he is also proud of the hospital’s ability to serve the civilian population. "We are a hospital for all," he says. "We treat soldiers, and we treat civilians. We are a hospital for all."
Despite all the routine, procedures must be constantly questioned

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to its own high expectations in the near future as well. Matthes also tries to continuously optimize relevant procedures while providing care in the trauma room. Emergency physicians work according to algorithms: prescribed treatment instructions outlining which measures must be performed under which criteria in which sequence. “Algorithms are important, but they are also a very static construct,” he says.

At the moment, Matthes and his colleagues would like to critically question when the whole-body scan is truly justified. Although the method is an outstanding diagnostic tool and has already saved numerous lives, it also subjects the patients to a high radiation dosage. “You can’t administer radiation as if you were using a watering can,” points out Matthes.

The doctors at ukb, who also publish scientific articles, may occasionally question their procedures. However, prescribed decision-making paths are indispensable in an acute emergency. “When you’re working, you have your mind on your algorithms; you’re focusing on one problem and you don’t think too much,” is how Dr. Michael Metzner, another attending physician at ukb, describes the situation. It is only after his work is finished that he sometimes falls into a chair and notices how exhausted he is. This was the case with one of the most serious accidents he can remember. A middle-aged man fell under unknown circumstances from the 11th floor. “The patient had serious injuries to the head, all extremities, in all body cavities, and to the pelvis. He was deeply comatose, and his relatives wouldn’t have been able to recognize him,” reports Dr. Metzner. The pelvic fracture by itself was life-threatening due to the vast blood loss.” The man survived thanks to the intensive efforts of a large team.

Patient exercise brings success

However, it isn’t enough to simply repair all of the wounds following a serious injury. A lot of patience and a lot of exercise are required before a person regains control over his or her body and can return to work. Many people with spinal cord injuries must learn to cope with life in a wheelchair. This is why trauma centers in Germany, which are sponsored by the employers’ liability insurance associations, also include many facilities for rehabilitation activities, including a modern gymnasium and a swimming pool.

“Everyone in Germany has a right to good medical care, but when I’m deciding on what measures are appropriate I also always have the patient’s age, occupation, and individual expectations in the back of my mind,” says Matthes. As far as he is concerned, thorough after-care is a key element of statutory personal accident insurance. After all, this is what makes it possible for patients to remain in outpatient care even after they have been discharged. And that, in turn, means he can support them for a longer period of time. Dr. Birgit Herden

“The primacy of trauma surgery”

PROF. DR. MED. MICHAEL WICH,
Deputy Director of the Casualty Surgery and Orthopedics Clinic at Unfallkrankenhaus Berlin, on the advantages of specialized emergency medicine

What advantages does the ukb possess when it comes to caring for the critically injured?

The primacy of trauma surgery is crucial. Everything is oriented toward the needs of the injured patient. If an experienced trauma surgeon feels that an operation is necessary at 3 a.m., his or her decision is accepted with no questions asked. How do you finance the high level of care that is required?

Roughly 25 percent of our cases are paid for by a statutory accident insurance company rather than a health insurance company because they involve work-related accidents. Payment in these cases is not according to the German Social Insurance Code (SGB) V, but rather SGB VII. Whereas the health insurance companies pay for “necessary care,” occupational accidents are treated “with all suitable means.” That’s an important difference. You also strive to always accommodate the emergency dispatch center’s needs. How do you manage?

The limiting factor is always the number of ventilator beds in the intensive care unit. We can increase this number by using our fully equipped intermediate care unit.
Hospital on the High Seas

Bumps, bruises, and third-degree burns—just like their colleagues on dry land, NAVAL PHYSICIANS have to be ready for anything.

The patient—a crew member—was suffering from a high fever, shivering, and an intense headache. His mouth was dry as dust, his muscles aching. As if that weren’t enough, he also had diarrhea and nausea—both much more pronounced than would have been the case for a normal dose of influenza. Ship’s doctor Dr. Axel Haber was informed, and found he had his first suspected case of swine flu to report.

The case occurred last year, the symptoms of the disease first presenting themselves three days after the frigate Sachsen had cast off from the port of Halifax in Canada. Due to the danger of a global pandemic, Haber and his colleagues had to take strict precautions: The sailor was quarantined and all the crew members were treated with the influenza drug Tamiflu. “Fortunately, we were at sea for so long that by the time we entered Liverpool on the other side of the Atlantic, the patient was already cured and the other crew members were beyond the incubation period. So, we were sure that none of the other sailors would be infected,” Haber recalls.

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naval PhysicianS

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“As a rule, medical emergencies on naval vessels generally involve trauma, while those on other vessels such as cruise ships tend to involve internal complaints,” Haber explains. There are, however, some basic similarities. In both cases, the ship’s doctor is responsible for all aspects of the patient’s wellbeing – as used to be the case with all doctors, before specialization fragmented the medical profession on land. For example, they treat even small wounds right up until the healing process is completed.

The advantage of treating patients onboard ship is that they can’t disappear. “I can take a close look at my patients every day,” says Haber. And should there be anything out of the ordinary, he’s already on the spot to take direct action. At most, a call to the bridge is required, and then the distance to the patient is no further than in a normal hospital ward.

Support from specialists on land

Every vessel in the German Navy has its own ship’s doctor. The sick bay team on a frigate, for example, can comprise up to five people: a ship’s doctor, an assistant ship’s doctor, two medical NCOs, and an enlisted man. On a task force support ship, there are eight more crew members, including two medical technicians. Should this prove insufficient, onboard medical teams can also request support from doctors in Germany – via the German navy’s own Medical Institute. “We have a workstation on board from which we can send diagnoses, X-rays, ultrasound images, and video sequences from anywhere in the world back to Germany for consultation with specialists,” says Haber.

And how would he deal with a case of psychosis? Haber explains that this has been known to occur and that it is one of the few reasons for removing a sailor from the ship, for example if a patient threatens to jump overboard. The crucial thing is to recognize any psychological changes on the part of personnel as early as possible. For difficult cases, there is also a military chaplain available. Things don’t usually get to that stage, though. “After we’ve been on board for a few weeks, I often know the sailors so well that I’m able to judge how resilient they are,” says the ship’s doctor. One factor that makes this possible is the relatively small crew on board – around 200 sailors compared to the 4,000 or so stationed in a garrison. If need be, the doctor can provide individual care for every sailor on board.

Haber has just gotten to know a new crew. In January, the Frankfurt am Main left its home port of Kiel in northern Germany for a five-month voyage to South Africa as part of a naval task force and training unit. During the course of this voyage, more than 200 cadets will complete onboard training. It is the trainee officers’ second voyage, following a sailing course last fall on board the training ship Gorch Fock.

Haber himself has obviously been to sea many more times than that. Five years from now, his 17 years of naval service will come to an end.

Björn Wölke

His workplace, the Task Force Support Ship Frankfurt am Main, is a double-hulled steel colossus with a length of almost 174 meters, a beam of 24 meters, and a draft of 7.4 meters – making it the largest craft in the German Navy. It is powered by two diesel engines that deliver a combined output of 14,500 horsepower (5.28 megawatts each) and propel the 20,000-ton vessel to a maximum speed of 20 knots (approximately 37 kilometers per hour). The job of these Berlin-class vessels is to provide logistical support to German naval units on missions abroad – including provisions, fuel, spare parts, and also medical care.

For the latter purpose, the vessel is equipped with a mobile naval hospital. This consists of fixed onboard installations as well as a two-story assembly of 26 special shipping containers – 20 and 30 feet in length – mounted on the upper deck. The containers, which are painted gray, contain a variety of treatment and diagnostic facilities, including two operating rooms, an intensive care unit, an X-ray unit, various labs, and even a dental unit. They can accommodate up to three medical teams working at the same time.

“If we don’t have a dentist on board, I’ll handle the drill myself,” says the Hamburg-born Haber, whose general medical knowledge must encompass a number of disciplines.

Cruise liners are different

The kinds of cases that Haber encounters can range from bumps and bruises to crush injuries caused by bulkhead doors – all the vessel’s cabins are pressurized – to severe burns, resuscitations, and even, on one occasion, an ectopic pregnancy on the part of a female sailor.

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Björn Wölke
Where gases show their colors

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With its first cry, a newborn baby crosses the threshold into life as a separate being and begins breathing. Oxygen is vital in this situation. Being without it for just a few minutes can be critical. What's more, it is essential that humans inhale this elixir of life in an uncontaminated form, because they have no defense against toxic gases. If the gases have a strong odor at low concentrations—as is the case with sulfur compounds (mercaptanes, for example)—the people affected can at least flee. But not every hazard announces itself. Carbon monoxide, for example, is odorless. Once leaked, gas is soon everywhere. The laws of thermodynamics ensure that it spreads.

Around 250 types of tubes A detection system must respond reliably to a variety of gases, identify them, and measure their concentration in the ambient air. “Dräger tubes come in a diverse spectrum of varieties,” says Bernd Wittforth, who heads this unit at Dräger. “Some of the hottest sellers among our roughly 250 types of tubes for up to 500 gases are tubes for the offshore industry,” he adds. “These are important when it comes to the detection of hydrogen sulfide.” Wittforth is also quick to point out the advantages offered by a fast-acting analysis technology used on site that requires no electricity and thus does not pose a spark hazard.

Measurement itself is easy. In principle, the user opens the glass tube at both ends using a device that looks like a pencil sharpener and places it in the atmosphere to be tested. The tube then changes color, depending on the gas concentration, between transparent and dark blue or brown. The various colors are determined in the laboratory. Who can identify the various gases by their colors? Dräger tubes for approximately 500 gases contain indicators that change color if a specific gas is present.
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A detection system must respond reliably to a variety of gases, identify them, and measure their concentration in the ambient air. “Dräger tubes come in a diverse spectrum of varieties,” says Bernd Wittfoth, who heads this unit at Dräger. “Some of the hottest sellers among our roughly 250 types of tubes for up to 500 gases are tubes for the offshore industry,” he adds. “These are important when it comes to the detection of hydrogen sulfide.” Wittfoth is also quick to point out the advantages offered by a fast-acting analysis technology used on site that requires no electricity and thus does not pose a spark hazard.

Measurement itself is easy. In principle, the user opens the glass tube at both ends using a device that looks like a pencil sharpener and places it in the manually operated “accuro” hand pump. The hand pump pulls a precisely metered amount of ambient air through the tube. If a particular gas is present in the air, it reacts with the indicator in the tube. This chemical reaction results in an easily visible change in color. The amount of this gas in the air in ppm—parts per million, in other words, milliliters per cubic meter, for example—can then be read off of a graduated scale on the tube. This colorimetric method was patented in the U.S. in 1919. Since Dräger presented its first tube for the detection of carbon monoxide using this technique in 1937, the company has helped to protect people by providing millions and millions of Dräger tubes. Today, in order to ensure the appropriate quality, these tubes are produced in Lübeck, Germany, in a technologically advanced and fully automated manufacturing operation.

But how do these nondescript glass tubes measuring some 125 millimeters in length and around seven millimeters in diameter actually work? At the center of the tubes is roughly two grams of a granular substrate that contains the chemical indicator. “The carrier substance,” explains Wittfoth, “comprises grains with a diameter of between 0.2 and 1.2 millimeters. Their exact size is a function of their intended application.” A total of 12 different carrier materials are used. “We are all familiar with the silica gel from the little bags that are often included as a drying agent with electronic equipment,” continues Wittfoth. This material is porous and therefore holds larger amounts of an indicator substance. However, if smaller amounts of indicator are sufficient to signal the presence of certain gases, smaller grains of glass are used as the carrier material. These grains are produced in the required grain size and purity from broken pieces of quartz glass in an in-house glass mill. “We are a batch plant and produce custom batches on an order-by-order basis,” explains Wittfoth. This keeps inventories low and the product reactive.

“The tubes have a chemical shelf life of 24 months from the date of delivery,” says Wittfoth, adding that random samples are taken from the batch and tested periodically during the shelf life period.

**Continuous tests**

In parallel, chemical technicians have been mixing the indicator according to a formula. Some 400 basic substances are available for composing the reagent system. “Each batch is custom mixed. Even the humidity can trigger undesired reactions. A formula therefore can’t really be repeated 100 percent,” says Wittfoth. This is why up to 70 complete tubes are >
produced for preliminary testing. These are used to check compliance with the specification immediately upon completion of the preparation. Once the combination of carrier substance (silica gel or grains of glass) and indicator have been individually matched, the material must be processed within the next six weeks. If this condition isn’t fulfilled, the test procedure begins all over again.

The Dräger tube reagent preparation is stored in 20-liter conical-shoulder bottles that are hermetically sealed with ground glass stoppers. Just as the chemical properties of the materials involved can be very different, so too can the physical properties. “Some materials are almost as sticky as honey,” says Wittfoth, “while others are so dry that they can become electrostatically charged while being filled into the tubes and adhere to the glass walls. At least that’s what would happen if we didn’t specifically dissipate this static electricity.” This is particularly important when various substances must be layered one after another in a glass tube. Altogether, as many as eight layers can be involved.

The tubes themselves are made of glass, whose type varies according to the intended use. High-quality laboratory glass grades such as Duran or “Duroplex” borosilicate glass are frequently used if extraordinary chemical resistance is required. The tubes, which are generally provided with one end already melted closed, resemble a pipette that is closed at the bottom. After an inspection aimed at detecting possible defects, the tubes are loaded into a filling machine. Only a machine can tap against the tubes 2,000 times with consistent precision and a force that is four times stronger than that of gravity.

Finally, the heat of the gas burner first makes the open end of the glass tube soft before it is melted closed (left). The mini-vacuum this produces is part of the process, which is checked and documented every step of the way.
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The analysis system is initially sealed using a layer of glass fabric that has been cut out from a strip of the material and has the shape of a circle. Something referred to rather floridly yet nevertheless appropriately as the “tulip” ensures that the grains are firmly secured. The tulip is likewise a circular blank that has been stamped from stainless steel wire mesh. It has a mesh size of 0.2 millimeters that has been formed into the shape of a tulip by means of a spine. The resulting folds generate the tension that results in the hold.

**Tapped 2,000 times**

Does it really hold? The answer is provided by a box that taps the tube 2,000 times with a force that is four times stronger than that of gravity. Nothing is permitted to shift unduly in the box. And only homeopathic quantities of the “substrate grains” at most are permitted to fall through the holes in the ceramic disk. This quality-assurance measure can only be performed after the tube has been automatically sealed, of course. The open end of the tube is first passed by a number of smaller gas flames, which not only make the glass soft, but also heat the air to the point that a mini-vacuum is established when the tube cools down after having been melted closed.

The tubes, which are still hot, are collected in a wooden crate (plastic would melt, and the glass would shatter upon contact with metal). A custom calibration scale is prepared for each batch produced. This is done by taking samples during production, testing the tubes with a variety of defined gas concentrations, and using these values to generate a batch-specific calibration curve. Even the aging of the tubes is simulated to ensure that they achieve the targeted chemical shelf life. The scale is printed on the sticky side of an adhesive film, which is wrapped around the tube. This arrangement also provides mechanical protection. “The scale must not only be accurate; the concentration of the detected gas in the ambient air in ppm, for example, must also be easily legible,” explains Wittfoth.

Under certain circumstances, pre-tubes are required to first break down the gas to be measured so that it can be analyzed. Dräger is particularly proud of its equipment’s ability to detect relatively stable compounds such as sulfuryl fluoride—a process that requires the air to be heated to roughly 900 °C in a pretube. How is this done without electricity? The trick is to use a chemical compound that releases energy when it reacts with the air.

Isn’t chemistry smelly by nature? “You don’t smell anything around here unless we are working with a lot of butyric acid,” says Wittfoth, wrinkling his nose. Isn’t it dangerous to test tubes that detect toxic gases? “No, it isn’t. That’s because the people who work in this field do so in accordance with the strictest of safety regulations and have the necessary qualifications.” The expert doubts that electronic systems will replace the Dräger tubes any time soon. “After all, the tubes are reliable, inexpensive, fast, and require no electricity.”

*Nils Schiffhauer*
Researchers at the Fraunhofer Heinrich Hertz Institute (HHI) in Berlin hope to change that. They have developed a 3D technology called “iPoint,” which works without a data glove or electronic markers on the fingers and can also translate spatial gestures into digital commands. The system comprises two infrared cameras that track the movements of the hand and communicate them to a computer. The computer translates the images, interprets them, and immediately executes them as commands.

From the kitchen...
HHI researchers were in Hanover in early March of this year for CeBIT, the world’s largest computer trade show, and demonstrated a scenario in which cooks were able to read a digital cookbook on a media wall, regardless of how sticky their fingers happened to be. To open the book, they used their extended index finger to move the mouse pointer onto an icon. They paged through the book by swiping contactlessly past the edges. They extended a fist to start the desired video and returned to the main menu by spreading all five fingers. And why not use gestures to turn on the range hood or the stove, play music and check your electricity consumption? A German celebrity chef has already equipped his culinary studio in the town of Goldental in the Pfalz region with the iPoint technology.

Beside the hygienic aspects, the contactless operation promises advantages with respect to the safety of the device itself. “This technology allows information to be communicated on the screen, have been around for many years. Multitouch technology even allows the use of multiple fingers at the same time. This intuitive, gesture-based method of operation shortens the learning curve and lets users get down to work right away. Man-machine interaction is still far from being contactless, however.

Headshaking in the Operating Room
Experts are researching how the CONTACTLESS CONTROL of technical devices can be utilized – in the kitchen, in train stations or in the operating room. What they found out will surprise you.

In the Western world, a brief nod generally signals agreement. Shaking the head signals the opposite. Wrinkling the nose expresses disapproval; a smile, on the other hand, great affinity. No touching and no listening are required – just looking is enough. There is no more efficient way for people to communicate with one another. But how well do gestures and facial expressions translate to the computer world?

Many cellular phones and laptop computers today have long moved beyond just the mouse or keyboard for operation. Touchscreens, with which users issue their commands via finger pressure directly on the screen, have been around for many years. Multitouch technology even allows the use of multiple fingers at the same time. This intuitive, gesture-based method of operation shortens the learning curve and lets users get down to work right away. Man-machine interaction is still far from being contactless, however.
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Beside the hygienic aspects, the contactless operation promises advantages with respect to the safety of the device itself. “This technology allows information systems to be operated even if the screens are behind glass or mounted three meters above the ground,” says Wolf-D. Konrad, who is responsible for developing new business areas at the HHI. “This would also them against vandalism in airports or train stations, for example.”

**... to the operating room**

The advantages of this technology in the operating room are likewise as plain as the hand in front of your face. After all, the boundaries between sterile and non-sterile areas must not be violated through tactile contact when staff members are adjusting medical devices or navigating through patient information system. Disinfecting control elements such as computer mice or touchscreens is very time-consuming and in some cases impossible because the chemicals used destroy the electronics. Other approaches have their own weaknesses. Placing touchscreens inside transparent disposable covers reduces the image quality and adds to the expense. And placing assistants in the non-sterile area so that they can perform these actions on call harbors a high risk of errors, particularly in the case of complex commands. The same applies to the direct voice control of the computers. The background noises in the operating room are often simply too loud.

So what does a contactless, yet reliable and accepted form of human-machine interaction in the operating room look like? And how can proven technologies be carried over to this environment? This essentially requires two steps: Navigate to the desired menu item and then

**Hospital-caused illness**

More people die from hospital germs than from the immunodeficiency disease AIDS. It is estimated that as many as one million Germans a year contract an illness while they are being treated in a hospital. Experts assume that between 170,000 and 250,000 of these nosocomial infections could be prevented if doctors and nursing staff would follow hygiene rules correctly and avoid typical transmission paths.

Infections due to the MRSA bacterium are a source of great concern to medical personnel. The letters SA stand for the pathogen “staphylococcus aureus” and the prefix “MR” means “methicillin resistant.” This means that the antibiotic methicillin no longer helps against the SA pathogen. In practice, the abbreviation has long ago ceased to refer to just this one individual case. Many pathogens are already immune to multiple antibiotics, and there is the risk that someday no antibiotic will be able to help.

By avoiding contact with medical devices that may be contaminated, iPoint technology can prevent the spread of MRSA and thus enhance patient safety.
The reliability of gesture-based control is being successfully researched

> execute the command with a mouse click. HHI researchers have provided two different ways of clicking in the contactless space: first, by holding the finger steady in space for a certain period of time, and second, by moving the finger in the direction of the screen. “These two methods were compared in the test and studied more closely in order to determine their advantages and disadvantages,” says test director Paul Chojecki as he explains the results. “What we found was that, contrary to our initial hypothesis, the time-based solution is easier to learn and was preferred by the majority of the test subjects.”

Chojecki warns against overvaluing these results, however, because the alternatives tested represented only a fraction of all the contactless control options. But one can learn a lot from him and his colleagues. They distrusted their own hypotheses and kept a sharp eye on the users’ fingers from early on. Real-world feedback is essential for translating novel technologies into commercial success.

Frank Grünberg

A sensor registers the up-and-down movements of hands and fingers.
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Dräger. Technology for Life®
A High-frequency Ejector Delivers Top Performance

The Babylog VN500 ventilator was specially designed for premature babies and offers powerful high-frequency oscillation in addition to conventional ventilation. An important component of the ventilator is the expiratory valve, through which the patient exhales. The Infinity ID antenna module transmits data from an Infinity ID hose system through the angled connector to the ventilator, where the data are processed. Up to 18 liters of compressed gas at a pressure of a maximum of 2 bars is propelled into the ejector each minute through two channels measuring only 0.65 millimeters in width. The ejector itself is made of nickel silver, where the gas is fed into connector 5. A lower pressure, resulting from the ejection supports the “active expiration” of the patient, which is controlled via the silicone membrane 6. The silicone membrane has a soft flat surface enabling a leak-free seal with minimal back pressure. A monocrystalline nickel disc vulcanized onto the back side ensures that it is perfectly flat.

The check membrane prevents pendular breathing in the event of a possible failure of the device. The muffler uses turbulence to reduce noise. The potential condensation is collected in the water trap 9. The entire assembly can be cleaned manually or processed in an autoclave at 134 degrees Celsius.