Ahoy!
A visit aboard a lifeboat  P. 28

Welcome!
When premature babies fight to stay alive  P. 38

Fire!
Dry conditions increase the risk of forest fires  P. 44

Together.
How cooperation works and what makes it so successful
6

YOU’LL NEVER WALK ALONE

Many things are better when done together. That is the evolutionary experience of all living beings. A look at how teamwork functions and what makes it so successful.

20

AMONG US

Geology detects deposits of natural resources; mining enables people to use them. The TU Bergakademie Freiberg has been teaching experts from all over the world how to make mining safer and more efficient for 250 years.

32

LITTLE ENEMIES

You can’t see them and yet they represent a danger to health, often even to life: Bacteria and viruses are everywhere, including where you least expect them. Their resistance to antibiotics necessitates rethinking.

Around 100 trillion bacteria live on every human, whether healthy or ill. Some of them are dangerous – more starting on page 32.
People going places
The Afghan geologist Sayed Mubin Rasa is doing his master’s degree in Freiberg, and Anna Khazigalieva is studying medicine in Vladivostock.

Strength in numbers
Humans only emerged from the darkness into the dawn of civilization through teamwork. Despite this long-standing experience, each collaboration brings with it new challenges.

Three in one
A new training facility provides even more realistic live fire training – including smoke gases. After all, firefighting is becoming ever more demanding.

In Humboldt’s footsteps
Mining will remain attractive in Germany even after subsidized coal production ends in 2018.

Rescue on the high seas
They have been going out when others fall in for 150 years: the men from the German Maritime Search and Rescue Association.

Danger out of nowhere
Medical progress is vulnerable. The danger not only lurks in viruses like Ebola and MERS. Multidrug-resistant pathogens also pose a serious threat.

Hanging by a thread
At what point is a premature baby viable? A look at the threshold area.

When forests burn
An area almost the size of Europe is destroyed by fire every year – from prevention to effective firefighting.

So near and yet so far
Even for Moscow the Eastern Siberian metropolis of Vladivostok appears to be at the end of the world, but committed doctors also work here and there is modern medical technology.

The launderette with a difference
When chemical protective suits have protected people from hazardous substances, professional cleaning makes them almost like new again.

At a glance
Products from Dräger found in articles in this issue.

Drug test for the coat pocket
The new DrugCheck 3000 – as reliable as it is practical.

IMPRINT
PUBLISHER:
Drägerwerk AG & Co. KGaA,
Corporate Communications
EDITORIAL ADDRESS:
Moislinger Allee 53–55, 23558 Lübeck, Germany
E-mail: draegerreview@draeger.com

EDITOR-IN-CHIEF:
Björn Wölke,
Tel. +49-451-882-2009, Fax +49-451-8827-2009
EDITING CONSULTANT:
Nils Schiffhauer
ART DIRECTION, DESIGN, IMAGE EDITING,
AND COORDINATION:
Redaktion 4 GmbH
TRANSLATION:
Lektornet GmbH
PRINT:
Dräger+Wullenwever print+media
Lübeck GmbH & Co. KG
ISSN: 1869-7275
CODE NUMBER: 90 70 400

www.draeger.com
Sayed Mubin Rasa, geologist at Jowzjan University in Sheberghan/Afghanistan

“Learning in a real mine was a completely new experience for me. I’m studying at the TU Bergakademie Freiberg for two and a half years. Working safely underground, where Dräger technology is often used, is always a very special moment for me. I work in Afghanistan as an associate lecturer of geology in Sheberghan in the north of the country. I was also born here. There is no history of geology or mining in my family – but I opted to do it nonetheless. The arid Afghan landscape is rich in natural resources, but there is a lack of specialists. There would be good opportunities for young engineers and scientists in the assembly sector, assuming the correct underlying political conditions. I am delighted about the AMEA program offered by the German Association for International Cooperation (GIZ), the German Academic Exchange Service, and the Bergakademie. Young scientists and employees from the Ministry of Mining and Oil come to Freiberg to do their master’s degree. Maybe in a few years I can play my part in creating a strong educational landscape for geologists and mining engineers in Afghanistan’s high schools.”
Anna Khazygalieva, medical student in her third semester, Vladivostok/Russia

“My dad actually wanted to buy me a restaurant. He said he would come there to eat with his friends. We went to the office that grants licenses. They asked me what kind of establishment it would be and I replied: ‘I don’t know; I actually wanted to be a doctor.’ They sent me away and told me I would be better off studying medicine. Although I love traveling, I wanted to study here. Vladivostok has really changed for the better over the years. It has become a modern city. The Far Eastern Federal University was founded in 1899, but the institute and the campus have only been there since 2013. I would like to do something worthwhile in my life and help other people. I am already allowed to prepare the injections. I find watching operations most interesting of all. There are also students from China, Japan, and Brazil here on the campus on the ‘Russian Island.’ I am still not sure what kind of doctor I would like to be. Diagnostics interests me.”
Underwater navigation:
Researchers believe that fish organize themselves into schools to protect the life of each other. The vibrant circular shape means that they are temporarily more than just a gathering of individuals. Their movement is clearly guided by the behavior of each other thanks to mirror neurons (discovered by brain researcher Giacomo Rizzolatti in 1992).
TEAMWORK is ubiquitous. Everyone is a team player somewhere in this globalized world – both professionally and privately. It is what made the dawn of civilization possible in the first place. These days many things only function through cooperation and are more enjoyable as a result.

Text: Isabell Spilker

The ambush worked; the spear hit the target. The mammoth was felled despite the icy conditions and the pitch-black night. One person lured the creature while another set the trap and someone else thrust the spear into its heart. The aim was to assuage their hunger and ensure their survival. This is what successful teamwork looked like when undertaken by a horde of Stone Age people – the key factor in the history of human evolution. It appears to be an anthropological constant. Who hasn't been asked about their ability to work as part of a team during a job interview? Working with others to achieve goals is probably a skill that most people like to boast about. It is quite simply one of the soft skills. Companies also like to draw on the abilities of teams. Gone are the days of heroic decisions taken single-handedly by one brilliant mind. Reality is generally complex, which is why it has become important to rely on the perception of many clever minds. An individual generally doesn't possess the necessary perspective.

As small and independent as possible
A team is always made up of two or more people. Seen in this way, a family is just as much a team as an actual sports team. And yet: "A working team has to deal with organizational issues and not just discuss the coffee and biscuits together," says Claudia Buengeler, professor of organizational behavior and human resources management at Amsterdam Business School and a
specialist in the area of diversity management of teams. Diversity management describes the way in which companies systematically attempt to use social diversity constructively. This not only involves suppressing discrimination, but also making a conscious effort to recruit – and retain – various types of people on the workforce. “They are united by one or more organizational goals and a modicum of social interaction. In the case of virtual teams this involves e-mails, video conferences, and chats.” From an evolutionary perspective teamwork has always existed; many things can only be achieved by working together. Deviations from this model only have a short half-life – such as Fordism at the beginning of the 20th century, when the production of goods was broken down into the smallest stages to improve productivity after the First World War. In the 1970s many companies began to rethink this way of working. The idea of teamwork involving small and independently acting units only began to reassert itself in the 1990s. In Uddevalla a Swedish automobile manufacturer even handed over its assembly operation to independent teams. The community became a high-end form of work – both efficient and social.

Aristotle knew that “the whole is greater than the sum of its parts,” and today’s social scientists and psychologists who deal with teams often like to quote this statement. Those who spread the workload across several shoulders achieve better results. However, it is not the spreading of the workload itself that makes a team. Its members have to cooperate, work things out together, benefit from one another, grow together, and ultimately be better than they would have been if they had acted as lone wolves. On the one hand, this caters to the demands of the world of work and business, but it also leads to greater satisfaction among employees, who can work more autonomously. “Responsibilities and working environments are becoming ever more complex,” explains Eric Kearney, professor of management, organization, and human resources at the University of Potsdam. “Previously there were more routine tasks. Nowadays employees are expected to think for themselves, be creative, question processes, and thus get better and more efficient at what they do.”

**Shared responsibility is what counts**

Shared responsibility and dependence on the efforts of others are the hallmarks of a team. Employees in today’s factories often work in so-called workshop organizations, which largely plan and carry out their duties independently. Crews represent special kinds of teams and examples include flight crews and firefighting crews. “Some of these teams only exist for a short period of time. There should be no safety risks as a result of well-rehearsed processes or favoritism due to special sympathies,” explains Claudia Buengeler. Both the workforce and structure can change constantly, yet very strong team players who can rely on each other are particularly important here. “It is no different for an OR team: Even though people tend to know each other here, each team member must be replaceable.” Studies have shown that teams have to work together several times over a longer period for maximum efficiency. Operating times are only significantly cut

“It is our conviction that there is no greater and more effective way of achieving mutual education than by working together.”

Johann Wolfgang von Goethe, 1749–1832

**HOW CAN A GOOD TEAM BE FORMED?**

**What can the individual do?**

- Get actively involved on a regular basis
- Don’t have any unrealistic expectations
- Identify with the goals of the team
- Try to work with colleagues in the team as best as possible – even if they are not personal favorites
- Address problems openly
- Avoid backbiting

**What can the management do?**

- Give team members the sense that every contribution is important
- Create a vision
- Clearly formulate and evaluate goals
- Assign intrinsically motivating tasks – stimulating, varied, integral – by rotating the team, for instance
- Encourage communication among each other
- Give people autonomy and the greatest possible freedom to make decisions
- Create a productive climate
- Make clear the necessity of the task or innovation – this often leads to better results
- Choose innovative team members who are open to new things
- Choose heterogeneous team members – good ideas also emerge as a result of dialogue between various people with differing opinions
- Give the team the opportunity to learn from one another and develop as individuals
- Allow mistakes, but draw useful conclusions from them (no penalizing)
- Reward the entire team as individuals when goals are achieved
- Monitor satisfaction within the team by conducting regular surveys
- Build bridges between teams – several teams not competing against each other, but working together to achieve the organization’s overarching goals
Cooperation par excellence:

With between ten and twenty million members, life in ant colonies is based on the division of labor. They have developed hunting and gathering skills and are equally adept when it comes to hygiene and waste management. This is only possible in communities which the biologists Bert Hölldobler and Edward O. Wilson call a „superorganism.‟ They also negotiate tasks together in smaller groups – and doesn‟t it just resemble outdoor coaching for management?
when the team members know each other, are familiar with their individual roles, and are aware of each other’s tasks: “In reality, however, this isn’t always so easy to implement,” adds Buengeler.

**Diversity – the key to success**

Things get fascinating when the team is made up of members from different backgrounds, whether in terms of culture, ethnicity, gender, age, or level of education. “Teams made up of different people often have much greater potential due to their various strengths alone. This is often the key to success,” stresses Claudia Buengeler. This may harbor the potential for huge conflict or it could lead to the formation of subgroups which then must be compensated by good management and a willingness to communicate within the team. “The diversity is a real treasure. Whatever each individual contributes must be made available to everybody through knowledge sharing and discussion. However, it is important to get people who are very different to share opinions and ideas with each other in the first place. This requires a great deal of trust.”

Raimund Erger has been a coach and trainer specializing in communication and human resources management for almost 20 years. “Teams don’t work by themselves; they have to regularly train the way in which they interact. Fire departments are not looking for individual heroes, but reliable employees who cooperate with one another,” he says, before adding that everyone is committed in a good team. Everyone is aware of their task and contributes their individual strengths toward achieving a common goal. “Communication is constructive and geared toward finding solutions; mistakes are discussed openly. People are loyal to each other; there is no backbiting and everyone stands behind each other.” However, not everyone is a team player. “People who are not adaptable have no place in a team,” says Raimund Erger. “Some have never learnt to work in teams, while
**Born Leaders**

**MARK VAN VUGT** is a professor of evolutionary psychology and organizational psychology and lectures at the VU University Amsterdam. He has shaped the theory of evolutionary leadership, according to which our desire to lead and to follow is innate and based on our evolutionary experiences.

**Leadership as a biological need: Do we really still prefer to follow the classic alpha leader?**

Not necessarily. But we have learned through experience that strong leadership works better in crisis situations than leadership by a person who tends to be more soft and non-assertive. For evolutionary reasons a physically commanding personality is preferred in times of crisis.

**How do you explain this?**

Over the course of millions of years we have developed prototypes in our minds that determine who we follow in different situations. The context is decisive in determining who we follow. These are completely functional decisions made in our minds as part of our evolutionary inheritance.

**Are there other examples?**

When an individual is generally rather unsure, they like to follow someone who knows more than themselves. This mostly means that they like to follow older people, because it is assumed that they have to know more by virtue of their age.

**According to this theory, who is the best leader within teams?**

In situations where the focus is on diplomacy, cooperation, and promoting teamwork, the prototype shifts to a less assertive leadership style, which is capable of integrating team members. If, on the other hand, a team or organization needs innovations, a younger person is often required. If traditions need to be upheld, then an older person is expected.

We are talking about what employees expect of their leader. But isn’t it the case that the team only rarely chooses their leader by themselves?

We definitely still see that today: A leader does not emerge from the group, but is appointed from above. As a result there is often a discrepancy between the kind of person desired as a leader and the kind that is actually appointed. The new way is for the group to choose their own leader for the areas in which they are competent. Hardly anyone has competencies in all areas. A good wartime leader is not necessarily a good peacetime leader. Good leadership is spread across several shoulders.

If the desire for leadership is something biological, is striving for power also biological?

Yes, striving for power is in the nature of mankind. We are descended from apes. Primates live in strictly hierarchical structures. Here it is better to become the dominant individual, because then you get a lot of privileges. It is in our nature to use positions of power for our own benefit: money, status, attractiveness. This is especially the case for male leaders. For them, power leads directly to all sorts of benefits. This isn’t so much the case for women. Although power is also highly coveted among women, they don’t use it so much for their own benefit.
others struggle. Someone who is unable to put themselves in the shoes of their fellow man has problems being a good team player. A good team member is prepared to feel responsible for others. In many teams, however, this feeling has to develop first and naturally requires people to make compromises. “A group that doesn’t work on team spirit cannot function on a long-term basis. It isn’t possible without a certain amount of joint effort and willingness to compromise. But when it does happen, the team can achieve a great deal,” says Raimund Erger.

**Leadership must be geared toward needs**

A lack of willingness to compromise restricts teams just as much as insufficient guidance from managers. If they are not completely transparent, it can quickly lead to uncertainty. A modern way of managing teams is known as transactional leadership, which relies on dialogue between the management and employees (“transaction”). Yet to what extent is there still a need for leadership nowadays? Many teams organize themselves and share management tasks among themselves. “The theory says that leadership remains effective when it satisfies the needs of the team,” says Claudia Buengeler.

Generally a distinction is made between a form of leadership based on a position and one based on the person and their attributes. The former relies on the manager’s status within the hierarchy. “The boss tells me what’s what.” A form of leadership based on personal strength, on the other hand, derives its competence from specialist knowledge and good arguments. “Ideally both forms run into one another,” observes leadership researcher Eric Kearney. “But there is a growing trend toward personal strength, because people are striving to achieve ever flatter organizational structures. This means that skilled individuals no longer need the hierarchical position to reach out to employees. Moreover, there are big cultural differences when it comes to the need for leadership within teams. Strong hierarchies tend to be the norm in Asian cultures, while in Scandinavia good arguments above all else are needed to lead a team.

**Error management: fail better!**

The hierarchy and communication culture within a team hinges on one final and critical success factor: How does the team deal with errors? Does it view them as an opportunity to improve things, or does it simply look for someone to carry the can? Many catastrophes, plane crashes, unsuccessful operations, or failed rescue missions can be attributed to an overly confident team which was too sure of itself and became careless, or an overly hierarchical team in which criticism was undesirable. Crew resource management (developed for flight crews to identify potential sources of error more quickly and reduce confidence when faced with higher-ranking colleagues) is now finding its way into operation rooms. “Dealing with errors in a suitable manner – in other words, having a good error culture – is already an important success factor; one of many,” says Claudia Buengeler.

It is not known whether the horde of Stone Age men debated who should throw the spear in future and from which angle after an unsuccessful hunt, but it is probable, because the hunt became increasingly more efficient. And yet this team needed a second team, a kind of back office, which was concerned with the preservation, preparation, and durability of the successful hunt. Sometimes one team just isn’t enough.

**LITERATURE AND LINKS**

Effective Teamwork in Healthcare – Research and Reality: [http://www.longwoods.com/content/18669](http://www.longwoods.com/content/18669)

Pamela Mitchell et al.: Core Principles & Values of Effective Team-Based Health Care: [www.nationalahec.org/pdfs/VSRT-Team-Based-Care-Principles-values.pdf](http://www.nationalahec.org/pdfs/VSRT-Team-Based-Care-Principles-values.pdf)

Mark van Vugt: Naturally Selected – The Evolutionary Science of Leadership, Harper Business

HOW GOOD IS YOUR TEAM?

Please indicate the extent to which the following statements apply to the team in which you work. You can also copy the questionnaire and give it to all team members so that you can subsequently discuss and evaluate the results.

1 = Not the case at all, 2 = Not really the case, 3 = Sometimes the case, 4 = Tends to be the case, 5 = Absolutely the case.

1. Everyone in this team is clear about what we want to achieve.
   1 2 3 4 5

2. We know that we can rely on one another.
   1 2 3 4 5

3. We have lively discussions about the best way of working.
   1 2 3 4 5

4. We meet frequently in order to communicate effectively.
   1 2 3 4 5

5. The team members quickly offer each other help at all times.
   1 2 3 4 5

6. We all have a say in the final decisions taken within the team.
   1 2 3 4 5

7. We keep each other updated with work-relevant matters.
   1 2 3 4 5

8. There is a sense of security and trust within our team.
   1 2 3 4 5

9. We are always open to new ideas.
   1 2 3 4 5

10. Everyone feels committed to the goals of the team.
    1 2 3 4 5

11. We can talk openly about mistakes.
    1 2 3 4 5

12. We agree on our goals.
    1 2 3 4 5

13. There is an atmosphere within the team that permits constructive criticism.
    1 2 3 4 5

14. We support each other when it comes to ideas for new and improved work processes.
    1 2 3 4 5

15. We provide mutual support when dealing with new tasks.
    1 2 3 4 5

16. Everyone within the team contributes to the decision-making process.
    1 2 3 4 5

Add the results together (take the mean value if there are several participants) and calculate the average for each category.

<table>
<thead>
<tr>
<th>Vision</th>
<th>Participative security</th>
<th>Task-based focus</th>
<th>Support for innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statement 1</td>
<td>Statement 4</td>
<td>Statement 3</td>
<td>Statement 2</td>
</tr>
<tr>
<td>Statement 10</td>
<td>Statement 6</td>
<td>Statement 11</td>
<td>Statement 5</td>
</tr>
<tr>
<td>Statement 12</td>
<td>Statement 7</td>
<td>Statement 13</td>
<td>Statement 9</td>
</tr>
<tr>
<td>Total</td>
<td>Statement 8</td>
<td>Statement 15</td>
<td>Statement 14</td>
</tr>
<tr>
<td>Average (total score/3)</td>
<td>Statement 16</td>
<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>Average (total score/5)</td>
<td>Average (total score/4)</td>
<td>Average (total score/4)</td>
</tr>
</tbody>
</table>

HERE’S HOW GOOD YOUR TEAM IS! AN INTERPRETATION GUIDE:

**Vision**
- Low average value (below 2.1): The team probably has no clear shared and tangible vision.
- High average value (above 3.4): The team has a clear shared and tangible vision.

**Participative security**
- Low average value (below 3.0): The team only meets on an irregular basis, or certain team members are not that involved in making decisions. There is a lack of trust. Some team members don’t feel confident enough to make suggestions to the rest of the team.
- High average value (above 3.4): The team meets regularly and all members are involved in making decisions. The majority feels confident enough to make suggestions. People trust one another; everyone fully assumes their role with an eye on common goals.

**Task-based focus**
- Low average value (below 1.9): The team cannot completely agree on giving its best. The team members may not be in a position to constructively judge their work. Assistance to develop new ideas is probably not available.
- High average value (above 3.8): The team is united in giving its best. The team members are in a position to constructively judge their work and get assistance to develop new ideas.

**Support for innovation**
- Low average value (below 3.2): There will only be little support for innovation. Stability comes before change.
- High average value (above 4.4): Innovation is encouraged and supported and comes before stability. To this end, the necessary resources are available to the team.

**Info:** Low average values indicate that measures aimed at developing the team in this area may be a good idea.
Walking through fire: Training with the Dräger Academy using the FTS 8000 LPG fire scene.
This training system opens up new possibilities in the area of **LIVE FIRE TRAINING** – LPG has been added to gas- and wood-fueled fire scenes for the first time. The technology not only exposes firefighters to high temperatures, but also realistic smoke gases.

Text: Peter Thomas

The team has brought the exercise in the Fire Training System 8000 (FTS 8000) to a successful conclusion. The fire training system from Dräger combines gas- and wood-fueled fire scenes with LPG for the first time. “The use of a fire scene which is supplied by LPG throughout the liquid phase is a new component in live fire training in Germany,” explains Lucas Kimmi from the Dräger Academy. In practice this means that the firefighters are confronted with a much more high-energy and intensive flame. The high temperatures, the rapidly spreading fire, and the smoke generated contribute to the realistic scenario. At the same time, the technology is more efficient than a wood-fueled simulation, because the individual stages can quickly follow one another. The FTS 8000 unleashes its full potential when the entire system with its T-shaped floor plan is set ablaze in the fourth and final module and all three simulation techniques interact. This very concept was met with wide approval among the

**FOUR WINS**

Training in the FTS 8000 consists of four modules which build on one another.

**Module I:** Fire behavior and phenomena of rapidly spreading fire – the focus is on teaching the physical relationships involved in fire behavior and learning about heat, smoke, and steam. Wood-fueled fire scenes are used.

**Module II:** Handling the nozzle – basics: This training unit, which takes place outside the actual training system, looks at the right tactics for using the fog nozzle. Besides existing extinguishing methods, the “up and down” method is primarily taught.

**Module III:** Handling the nozzle – advanced: The methods learned in the second module are put into practice against the wall of flames in the LPG fire scene – other elements are also added, such as the opening of fire doors.

**Module IV:** How to tackle interior fires – combination under real conditions: In the final training unit the skills learned to date are put to the test under stress in a highly realistic fire situation.

The flames were still blazing bright orange and red when suddenly the cloud of smoke gases and soot rolled along the ceiling: black, hot, and dangerous. Seconds later the men in the firefighting team could barely see their hands in front of their faces. Further back, the burning fire can only be imagined through the thick smoke, yet the firefighters hold their nerve. They direct the broad jet of water upward from the fog nozzle and guide the cooling fountain downward using an ever narrower exit angle. Steam rises before the much-anticipated command is heard: “Fire out!”
Ideas from abroad complement the specialized training

Firefighters who were given the opportunity to train with the new system before its official launch in June (at the Interschutz trade fair). “The combination of three different technologies in one system is impressive,” says Oliver Jäger, for instance. One week previously the head of the breathing protection center in the Bavarian district of Aschaffenburg took part in an active training cycle with the FTS 8000. Today the expert is once again a guest. At the breathing protection center in Bad Kissingen he is taking part in a professional dialogue with product specialists from Dräger in order to add to his experiences from the training units. In the yard of the training center three blue 20-foot shipping containers rise above the Frankish skyline. They form the shell of the modular training system.

Learning from Sweden

White and gray smoke once again billows from the slightly opened door of one of the containers. The plumes of smoke rise in the sky. They signal the first module of the live fire training, the focus of which is on a wood-fueled fire scene. Thin wooden boards, which disintegrate in flames, provide sufficient heat and smoke behind the blue steel walls. The conditions in a real room fire are even more extreme when items
of furniture made of plastic catch fire. The trainers taught the participants this in emphatic style by showing a video a few minutes previously during the theory part.

A good year of intensive work is behind the new system and the associated training concept. The Dräger engineers have enhanced proven technology and complemented it with ideas from abroad. “The dialogue with the specialists from the Swedish Rescue Training Centre (SRTC) was especially fruitful,” says Lucas Kimmi. A wealth of experience using the LPG technique in live fire training had already been gathered there. The Scandinavian colleagues also provided suggestions for enhanced training using the fog nozzle in line with the so-called “up and down” method – this is the focus of the second module. “In terms of the approach, ‘up and down’ is calmer compared to the more common ‘pulsed’ method, which involves opening and closing the nozzle alternately to extinguish the fire,” says Kimmi. The tactical and practical knowledge is then applied in the simulated LPG fire scene. The crowning glory is module number four, which involves a complex operation to tackle the fire inside the entire system. The individual techniques are used in parallel here – the meter-high flames and smoke gases now reach temperatures of up to 250 degrees Celsius.

Proven methods are complementary

The fact that the training is delivered gradually in four separate modules should foster a long-term learning effect, says Dräger expert Kimmi. “The teaching of knowledge is just as important as a convincing representation of a fire event in order to prepare firefighters for the physical and psychological stress associated with fighting a real fire inside a building.”

The training concept (Dräger FiRE 8000) does not challenge established training methods, but complements them by adding a new component. Accordingly, the four modules – embedded in a safety concept specially developed for the system – are set to offer breathing apparatus wearers additional training options for real situations after successfully completing the basic training.
At the end of last year Dräger finished development work on the system prototype. It was subsequently subjected to a tough performance test involving experts from firefighting training schools, professional fire departments, works fire departments, and volunteer fire departments. “These were experienced opinion leaders who train other professionals in the area of breathing protection,” says Lucas Kimmi.

The FTS 8000 was installed at five different locations in the first months of this year, including Oberthulba and Leipzig. People continuously discussed the issue of how innovative technology can meet future demands in live fire training. Sometimes it only involved practical details relating to the structural design of the system. As a result, for instance, the LPG fire scene was fitted with an additional shield so that the firefighters could no longer see the little pilot flame during training. The flickering ignition source spoiled the realistic impression when the trainer extinguished the huge sea of flames at the touch of a button. The trainers from the Dräger Academy accompany the training course participants throughout all the modules in the container. Brief feedback sessions between the training and theory consolidate what the participants have experienced. “With the entire program we are passing on the knowledge that we have built up over decades as the manufacturer of simulation systems,” says Kimmi.

Yet it is not just knowledge that is part of the training program, but also spectacular images: No sooner does the door on the side of a container open than the black box spews out thick smoke, through which the group walk into the daylight in single file. Now they have to take off their equipment, catch their breath, and drink sufficient fluids. Their faces appear from underneath their masks: red from their efforts and yet beaming after having completed the training.
“Operations are now much more demanding”

Live fire training is becoming ever more important in the training of German firefighters. JÜRGEN WEISS, specialist consultant from the Bavarian state firefighters’ association, and JÜRGEN DIETZ, head of the works fire department at the Industrie Center Obernburg (ICO), talk about the challenges and potential associated with this training.

Mr. Weiß, does the future of live fire training lie in a combination of various fire scenes?

Weiß: It is definitely a very good way of injecting even more reality into firefighter training – and that is very important in view of the increasing demands.

To what extent has the training of firefighters changed through the use of training systems?

Dietz: In recent decades extinguishing operations inside buildings has become much more demanding. Training in fire simulation systems is an essential way of preparing firefighters for the physical and psychological stress they can expect before even attending their first real blaze.

How is the fire simulation technology currently used?

Weiß: In Bavaria firefighters can now train in the static fire training house, at the state firefighting school in Würzburg, and with seven mobile fire training systems. All systems are powered by gas – a new addition in 2015 is the wood-fueled fire training container. In the state of Bavaria alone this equipment is available to 7,700 volunteer fire departments with around 320,000 active members, including around 65,000 wearers of breathing protection.

How is the training technology being received?

Dietz: Young firefighters in particular consider such training to be extremely important for preparing them to tackle blazes. The ICO works fire department is working with the district of Miltenberg and acts as the interface between many firefighters. We offer the breathing apparatus training course to every department in the district.
An especially important place for mining scientists can be found 100 meters below the Saxon town of Freiberg. The origins of the "REICHE ZECHE" mine date back to the silver mining activities of the 12th century.

The future is underground – where it is dark, where the mine railroad trundles through kilometer-long tunnels like an iron lindworm to bring students and researchers from all over the world to their place of work. Welcome to the “Reiche Zeche” research and education mine of the TU Bergakademie Freiberg! The mine, open again to visitors since summer 2015 following two years of extensive renovation work, is an indispensable part of the traditional university established 250 years ago. In addition, it has enjoyed the status of being an experimental mine since 2005.

“Our mine is a real case for science,” says Helmut Mischo, professor of mining and special underground processes at the TU Bergakademie Freiberg. His office is located directly above the shaft, which was sunk in 1841 and remains in operation to this day. Even though silver mining ended in 1913 – with the silver used to make coins until the 19th century – another
ldt’s

Where education has replaced silver as a coveted commodity: a seminar at the TU Bergakademie Freiberg on the first level of the “Reiche Zeche” mine
Winter semester 2015/16: a new study module on mine rescue

commodity has played the key role since then: education! After all, realistic mining not only involves researching technology, but also finding safety-related solutions. According to Professor Mischo, this subject is driving a number of companies in the mining sector. The mining industry has undergone dramatic change since the 1990s. In Germany many labor-intensive mines are closing, such as those in the coal sector. At the same time, old pits are being reopened or new mines excavated if valuable natural resources for high technology can be found there (see also the interview on page 25).

Silver for the mints
What exactly has gone on in Freiberg until the present day? In the 12th century the first miners excavated their tunnels with hammers and chisels in search of silver ore. Most of the silver ended up in the mints of the House of Wettin from the 16th century to produce the reichsthaler, among other things. The princely graves in Freiberg Cathedral, not far from the “Reiche Zeche” mine with its striking pit frame, are a reminder of this time. These days, the university’s data cables run along the passages at gigabit speeds to transmit results from new mining methods, tests on innovative conveyor equipment, and trials of sensor technology used in various disciplines such as geophysics and gas measurement. There are blasting chambers, test stations for hoist cables made of textile fibers, and there is real mining. That’s because the researchers have to excavate caverns in order to set up new laboratories. Various facilities are being planned here under the name “EuRockLab” – primarily on the third level, which is surrounded by hard rock and provides plenty of space for customized extensions.

The subject of mine rescue will also be covered in future. From the winter semester 2015/16 the TU Bergakademie will be offering a new study module on safety and risk management underground. It is aimed at students
at the TU Bergakademie who come to Freiberg to educate themselves in the area of mining science. “Those who will one day be responsible for rescue and risk management in the natural resources industry simply must know how it all works in practice,” says Professor Mischo. This is also the reason why further investment is planned in mine rescue technology as part of the new study module.

The background to the new course is the fact that new mines can function with comparatively few workers thanks to the use of effective mining methods. This will change the conventional way in which mine rescue is organized and require even greater cooperation and networking between the individual locations. This development is international.

**Mine rescue on the timetable**

The two-semester modules “Safety and Rescue in the Natural Resources Industry” and “Mine and Gas Protection Barriers” link theory and practice to already existing content from the mining course in Freiberg. Among other things, the education mine is equipped with breathing protection and gas measurement technology from Dräger. “Acquiring real experience in this way is hugely important,” says Thomas Bote, account manager at Dräger. However, the safety equipment is not only used for teaching purposes, but would also be used in the event of an emergency in Freiberg.
Exhibition: 250 years of university history on 275 square meters

or elsewhere. That’s because the employees at the TU Bergakademie have undergone training to qualify as mine rescuers at the headquarters of the professional association for the natural resources and chemical industry in Leipzig – also against the background of the reopening of the “Reiche Zeche” mine to visitors. When students familiarize themselves with modern breathing protection technology from autumn 2015, it will be like traveling back in time to the origins of the TU Bergakademie. The safety of miners confronted with harmful gases also interested Alexander von Humboldt (1769–1859). The young naturalist enrolled at Freiberg in the summer of 1791. The university established 26 years previously had already enjoyed an excellent reputation. In his memoirs Humboldt praised the hands-on practical approach: “However many renowned chemical analysts Germany may have, few of them are close enough to the mines to analyze freshly collected air samples.”

Humboldt went to Freiberg to prepare himself for the position of mining assessor in the Prussian civil service. While there, he also gathered significant ideas for the development of an early form of the miners’ safety lamp. Invented in 1796, it is also one of the exhibits on display in the Historicum, a newly opened exhibition to mark the 250th anniversary of the traditional university. “Humboldt’s work, which at the time also included the unfortunately ineffective breathing bags, represent early approaches to modern mine rescue,” explains Dr. Norman Pohl, who manages the Historicum. The development of the TU Bergakademie since it was established on November 21, 1765 is documented here on an area covering 275 square meters. The exhibits include the historical lectern and chair, mineralogical samples, functional models and accounts of the political and historical context.

More than 5,500 young men and women from all over the world now

History:
Decommissioned mine railroad wagons greet visitors at the entrance to the “Reiche Zeche” mine

Man machine:
Autonomous work equipment is the future of mining. The robot “Alexander” – named after Alexander von Humboldt – made its debut in Freiberg on July 1, 2015

PHOTO: TU BERGAKADEMIE FREIBERG / ECKARDT MILDNER
Professor Mischo, the end of the Carbon Age appears to be near: What career chances do your graduates have against this backdrop?
The future for mining experts is excellent throughout the world. Germany is and will remain a mining country, even though coal mines will no longer be operated here. Instead, large amounts of fluorite, kaolin, and salt are being mined from the earth. In the coming years there is huge potential in the mining of natural resources such as lithium, germanium, and indium. There are also large deposits of such metals in Germany. They are used to produce computer chips and solar cells, are extremely scarce and accordingly sought-after.

Is there any substance to reports about the new Berggeschrey (or “mining clamor”) in the Ore Mountains?
The current situation has little in common with the silver rush of the Middle Ages, which went down in history as the “Great Berggeschrey.” But it is correct that we are aware of very attractive deposits of natural resources in the old mining areas such as the Ore Mountains. They were previously uninteresting for industry or couldn’t be efficiently exploited. This has changed thanks to new technology and as a result of the strong demand for certain metals.

Will the miners soon be reaching for their tools once again?
It is clear that mining in this country is experiencing something of a renaissance. But don’t be under the impression that deposits in a high income country like Germany will be mined solely using classic methods and we will witness scenes like 50 or 100 years ago. Instead, new methods such as biohydrometallurgy and autonomous machinery will shape the future of mining in this country.

What exactly is behind biohydrometallurgy?
This term describes the use of microorganisms in mining. Using a liquid they are fed into the mining area, where they oxidize metal sulfides into sulfates. These sulfates are highly soluble in water and can be leached from the rock. This also makes it efficient to utilize such natural resources which would otherwise be costly to exploit with conventional methods due to their low concentration in the rock or their location. Such technologies are also interesting for obtaining metals from old slag heaps and other sources.

Do you develop technologies of this kind on your own initiative?
Yes, we work with a whole range of processes that take a clever and promising approach to dealing with natural resources. This is also the reason why we want to further expand our research establishments. To this end, for example, a new access point to the third level of the mine is set to be opened up in the coming years.
Since January 2015 students from Afghanistan have been studying for their master’s degree in geology at the TU Bergakademie Freiberg. As qualified teaching staff at universities in their home country, they wish to develop and expand mining there.

The pit cage rumbles as it descends. Water drops shimmer in the glow of the headlamps on the cage’s swinging safety curtain. Bright eyes look out from under the white helmets as the descent comes to an end and the group gets out at the first level of the “Reiche Zeche” education mine. Here, about 150 meters below the earth’s surface, the group of young men and women gather around Volker Theuerkauf and Frank Liebscher at a temperature of ten degrees Celsius.

Today the mining engineer and geologist are leading a field course on how to measure air currents. The lesson is given in English. That is the common denominator between the lecturers from Freiberg and the students from Afghanistan. They have been studying at the TU Bergakademie since January 2015 as part of the AMEA program (Academic Mining Education in Afghanistan) with a view to completing their master’s in 2017.

“There are 15 students in our group,” explains Sayed Zabihullah Shadah. The 29-year-old works for the ministry for mining and oil in Afghanistan. There is a desire to improve mining education in Afghanistan on a lasting basis, explains Professor Carsten Drebenstedt, project manager at the TU Bergakademie Freiberg. “By giving young scientists the skills to take on the teaching roles at universities in their own country, we are boosting the development of Afghan mining – and society – over the long term. Other project partners include the German Academic Exchange Service and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

Air current monitors
Underground the group makes its way to the chosen measuring point. Determining the direction, speed, and volume of the air current is one of the most important tasks in mining. “Knowing how the air is behaving underground is a prerequisite for making use of it,” says engineer Theuerkauf. “Regular checks are essential, because the air currents are dependent on a number of different factors – such as the weather conditions above ground and the structure of the mine.” In the “Reiche Zeche” mine, for example, up to a third of the fresh air that passes into the mine is lost through the old mine, which dates way back to the Middle Ages. The scientists at the TU Bergakademie have created a completely digital model of the air in the mine to try to understand this phenomenon.

This morning, however, the students are relying on a classic tool to determine the air current: The air speed is measured with an anemometer, by which they calculate the cross section of the tunnel by taking the average height and width. The aspirated hygrometer provides information about the air temperature. Meanwhile, technology performs the task of monitoring the air currents for harmful gases: Two static gas detectors (type: Dräger Polytron) are installed at a central point of the outgoing main air current. They raise the alarm as soon as the concentration of a monitored substance rises.

The pens scribble furiously across the paper of the notebooks at the location where the air current is measured. Dia-
grams and short sentences fill the pages. In addition, the students constantly ask questions about the measurement tools and formulae. They finally get a chance to try them out and practice the relevant hand movements. The calculations are performed later in the Ziegenstall ("goat shed") – a conference room on the first level, named after an anecdote from the everyday history of the miners.

**Native specialists and managers**

How will the students implement what they have learned in their own country? There is certainly plenty of demand for qualified teachers, says Sayed Zabihullah Shadab. “Effective mine management with native specialists and managers is required to establish a functioning natural resources sector,” confirms Professor Drebenstedt. Afghanistan is rich in mineral resources. Some of these deposits have been used for centuries. The lapis lazuli inlays in the Taj Mahal in India, for instance, come from Afghanistan.

*After the measurements come the calculations:*
The Afghan master’s students determine the air current together.
Hermann Helms lifeboat: The 27.5-meter-long boat entered service in 1985 and has saved many people from life-threatening situations.
They put out fires, find missing people, and evacuate stricken ships: The RESCUERS from the German Maritime Search and Rescue Association in their characteristic red work clothing are multi-talented – and they have to be, because every minute counts when there is an emergency on the high seas.

Eleven degrees Celsius. That is the yearly average water temperature of the German North Sea as measured by the Federal Maritime and Hydrographic Agency. Those who fall overboard here don’t have much time. Then they die – from hypothermia, exhaustion, or because too much water has entered the lungs. Just a quarter of a liter is enough to drown. As a rule of thumb, a person can survive for one minute per degree of water temperature. Yet there have also been cases where people have been rescued after spending days in cold water measuring just a few degrees. "Rescues on the high seas always come down to time; not even the best life jacket can change that," says Holger Wolpers, captain with a license for deep waters. He has a few tips on what somebody who is shipwrecked should do to prevent themselves from suffering a cold death: "The first thing to do is to stay calm; do not lose your nerve – even if it’s difficult. Gasping for breath is not helpful. And it is vital to keep on as many layers of clothing as possible!" Wolpers should know. He has been a seafarer since 1985, initially working for SAL (Schiffahrtskontor Altes Land). Some routes took him to the Persian Gulf, Asia, and icy Greenland. Since November 2011 he has been at the helm of the Hermann Helms lifeboat belonging to the German Maritime Search and Rescue Association, which is celebrating its 150th anniversary this year.

The German Maritime Search and Rescue Association was founded on May 29, 1865 to help people in distress at sea. It has rescued way in excess of 80,000 people from life-threatening or dangerous situations. The association is called upon a good 2,000 times a year and finances itself solely from voluntary donations. More than 800 volunteers and 180 full-time employees are constantly on-call at 54 different stations. Help is usually at hand within the shortest space of time wherever the fleet with the red Hanseatic Cross is in service along the North Sea and Baltic Sea coasts.

Journeys into the unknown
They respond to emergencies such as this: In April last year a shrimp boat keeled over in the Elbe estuary. The accident was probably caused by a net that had got snagged on the seabed and pulled the boat over. Wolpers and his crew rescued the threeman team unharmed from their sinking ship. "It was one of the trickiest operations of the year. Nothing can be predicted; every operation is different and you never know what may come up," says Holger Wolpers, describing the varied nature of his job. "In the end, we always try and make the best of it." Salvaging a ship...
from high surf is always problematic, especially when it is taking on water. “Then we have to act quickly to refloat it so that it doesn’t flood at the next high tide.”

Fortunately such operations are now a rarity. Satellite navigation and steel hulls have made seafaring much safer in recent decades. As such, Hermann Helms usually has to rush to the aid of water sport enthusiasts and leisure boat captains during the summer months. In winter, on the other hand, most callouts involve commercial seafarers. In addition, there are mudflat walkers trapped by the tide and patients from cruise ships who require medical care on land. Initial treatment, which is often given for preventive reasons with an emergency ventilator (type: Dräger Oxylog), is generally administered in the mess where the team eat their daily meals. Four full-time rescuers work shifts on the Hermann Helms in the home port of Cuxhaven, two weeks at a time, 24 hours a day. That’s how long a shift lasts. Between them, Wolpers’ team members have more than 60 years of experience under their belts and they have been able to save many lives. The Hermann Helms is called out around 90 times a year. Its area covers around 16 nautical miles to Brünsbüttel and 24 nautical miles to the Elbe estuary. “But we also sail to other areas when something happens further afield and we are called to it,” says Wolpers.

A cold yet warming handshake
His 27.5-meter-long boat cost almost five million euros, was built by Lürssen in Vegesack, and put into service in 1985. The three diesel engines are capable of 3,194 horsepower (2,349 kW), propelling the ship to a top speed of 24 knots (44 km/h). When engineer Gerhard Dreeßen, who has been with the German Maritime Search and Rescue Association for 35 years, starts the units, the engine room and the hull briefly shudder. The ship’s hull is made of seawater-proof aluminum with a double outer wall. Three infinitely variable propellers can finely change the

Reckless leisure boat captains: “Many claim never to have heard of ebb and flow tides”
speed, and the bow thruster makes the ship especially agile, even in harbor basins. Batteries of radio and direction-finder equipment provide unrestricted communication with the fire department and other support organizations on land. The crew wears special red suits. Also red is the powerful fire pump, which not only exceeds the capacity of many other special ships, but can also cloak the lifeboat in a mist of water for self-protection purposes – with 2,000 cubic meters of water an hour. On standby at the stern of the ship is the smaller 180-horsepower boat *Biene*, which can be launched into the water and hauled in again within seconds using a hydraulic cable winch and a ramp. With a draft of 80 centimeters it is perfect for use on the tidal flats or close to beaches or sandbanks.

Which human frailties don’t always go down well when it comes to reckless leisure boat captains? “A lack of knowledge of the area,” says Wolpers. The North Sea has tidal waters, yet word hasn’t yet gotten round to everybody. As a result, many a leisure boat captain with experience of the Baltic Sea has run aground in the North Sea during the ebb tide. “Many of them claim to have never heard of the ebb and flow tides,” says a surprised Wolpers. This natural phenomenon of tidal currents is based on the gravitational pull of the moon on the earth’s bodies of water. The North Sea is linked to these via a very broad opening to the Atlantic Ocean, primarily north of Scotland. The Baltic Sea, on the other hand, is only linked to the North Sea – and thus to the world’s oceans – via a relatively narrow strait at Skagerrak. This makes it virtually a semi-enclosed sea with a barely perceptible tidal range of up to 15 centimeters. Holger Wolpers takes some lack of knowledge about it calmly. His message to all leisure boat captains: “Familiarize yourself with the waters in which you are sailing, and, above all else, look after your boat!” He says this, because he has also seen cases where the engine was running, but the crucial bolt had not been properly tightened and the propeller had come off. And those he rescues? Wolpers says that they are generally very grateful. “With a nice, cold handshake that comes from the heart.”

**28-meter class already in the starting blocks**

The *Hermann Helms* is now in its 30th year of service. If everything goes according to plan, it will soon be replaced by a new lifeboat in the 28-meter class. Wolpers doesn’t like to talk about it. Like almost all captains he has an emotional bond to his boat. Sometimes he contemplates. He already has a new name. If it were up to him, it would be called *Hermann C. Helms* – after the son of the chairman of the German Maritime Search and Rescue Association from 1943 to 1980, the Herman Helms whose name his boat bears. Wit and charm are often never far apart.

*In calmness lies strength:* Gerhard Dreeßen, first engineer, is in charge of three diesel engines and 3,194 horsepower, with which the lifeboat reaches a top speed of almost 45 km/h.
Medical progress is vulnerable. New or old pathogens can trigger a PANDEMIC at any time. On the world stage they are known as influenza, Ebola, or MERS-CoV. In hospitals, meanwhile, multidrug-resistant pathogens are lurking.

In the New England Journal of Medicine, Microsoft founder Bill Gates recently called for a well-equipped and professionally staffed international institution for managing epidemics. Gates also advocated a better early warning system and a rapid medical response team capable of organizing and controlling matters at the local level in the event of an emergency.

With his Bill & Melinda Gates Foundation he is one of the most important financial backers of humanitarian projects around the world. Gates knows that the Ebola epidemic will not be the last. There are enough candidates. In South Korea there was a MERS-CoV outbreak in the summer of 2015. HIV continues to spread around the globe and next winter will bring with it new influenza viruses. These are currently considered to be the most likely triggers of a global pandemic, because each influenza season produces new strains.

Influenza viruses are so dangerous because – unlike Ebola or HIV – they spread through the air. Fleeting germs travel around the globe by plane. It became clear just how quickly this can happen ten years ago during the SARS epidemic. A kidney specialist contracted the virus in a Chinese hospital. A few days later he traveled to Hong Kong, where he infected dozens of employees and guests in the hotel where he was staying. They in turn brought the SARS coronavirus to Vietnam, Canada, Singapore, and the United States. From there it spread to a further 24 countries before the chain of infection could finally be brought to a halt five months later.

Animal shed risk

However, there is not only a danger from the already known viruses and bacteria. Pathogens with new characteristics are appearing all the time, because human and animal habitats are moving ever closer together. Sixty percent of the pathogens come from animal sheds or the wild. HIV was probably transmitted to humans around 1920 through the consumption of ape meat. A total of

Text: Dr. Hildegard Kaulen
Nine-year-old Nowa Paye from Liberia is taken to an isolation ward by paramedics after showing symptoms of the Ebola infection. The hesitant approach taken by the world community may have cost many lives in Sierra Leone, Guinea, and Liberia.
Chains of infection are broken by good hygiene

39 million people have died from AIDS since then. No fewer than 35 million people live with a viral infection. Dormitories are the probable source of the pathogens found in MERS-CoV, while the SARS coronavirus was transmitted to humans through the consumption of civet cats. The two cannot be examined separately due to the close link between public health and animal health. “One Health” is one answer to the question of how to prevent pandemics, which was also discussed at the G7 summit in Elmau in 2015. It means that pandemics can also be prevented in the animal shed and stemming viruses in animal populations is no subordinate task. Rich countries would be well advised to help poorer countries in this regard.

In Germany pathogens such as Ebola, MERS-CoV, and SARS coronavirus are sometimes only seen as a distant problem. German citizens feel safe and overlook the fact that there is also a considerable risk of infection in their own country. It is simply a different situation. The pathogens are lurking in different places, have different names, but are no less dangerous. They live in hospitals, on intensive care wards, and in retirement homes, and are known as Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa, MRSA, Candida, Klebsiella, Enterococcus, or Clostridium difficile. They cause wound and urinary tract infections, inflammation of the lungs, septic shock (see also Dräger Review 110, page 32 ff.), and diarrhea.

ENGLISH SWEATING SICKNESS: A VANISHED INFECTIOUS DISEASE

Sometimes infectious diseases vanish into thin air. English sweating sickness is one such case. The disease was first recorded in London on August 28, 1485 and never reappeared after 1551. During the interim decades it caused five epidemics. The malady began with violent shivers, giddiness, headache, pain in the limbs, and extreme malaise. This was followed by foul-smelling outbreaks of sweat, delirium, rapid pulse, and impaired consciousness. Death followed within hours. Most of the victims died on the same day as the symptoms appeared. The foul-smelling sweat and the country of origin gave the disease its name. It mostly appeared during the summer months and primarily afflicted upper-class men aged between 30 and 40. Among the famous survivors was Anne Boleyn, for whose sake King Henry VIII later broke away from the Catholic Church. To this day, nobody knows what caused the disease. It may have been hantaviruses. When some victims were exhumed in 2001, no pathogens could be established using DNA analysis.

Since many of these bacteria are multidrug-resistant and no longer respond to common antibiotics, around 18,000 people in Germany die every year. As such, the death toll due to hospital-acquired infections in Germany in 2014 was higher than that caused by Ebola in Sierra Leone, Guinea, and Liberia. “Multidrug-resistant hospital bugs are the pandemic of the 21st century,” says
Dangerous pathogens

Infectious diseases are among the leading causes of death around the world, and new pathogens are emerging from animal sheds and the wild all the time, against which drugs and vaccines must be developed. HIV infections, tuberculosis, and malaria claim the majority of fatalities. To date, AIDS has cost 39 million lives.

Professor Axel Kramer, director of the Institute for Hygiene and Environmental Medicine at the Ernst-Moritz-Arndt University in Greifswald. The hygienist is in no doubt that the spread of multidrug-resistant bugs could lead to a menacing epidemic.

The downside of highly advanced medicine

Hospital-acquired infections are the price paid for medical progress. Sick people can now be treated better than ever before and life expectancy has never been higher. Accordingly, there is an increasing number of old and multimorbid people whose lives are fragile due to their age and sometimes serious illnesses. This makes them susceptible to hospital-acquired infections, also known as nosocomial infections. The term is derived from the Greek words for “illness” and “care.”

“We know from a survey coordinated by the European Centre for Disease Prevention and Control using point prevalence data that almost four percent of patients treated in hospital in Germany...
contract a nosocomial infection," says Kramer. “This equates to around 730,000 infections a year.” Kramer views the fact that the number isn’t even higher as a success. After all, if nothing had been achieved, there would have to have been far more diseases caused by hospital-acquired infections due to the changing patient structure.

He views the growing resistance to antibiotics as the biggest challenge. If there were enough effective antibiotics, nobody would be talking about hospital-acquired infections, because they would be easy to treat. MRSA is one of the most notorious pathogens. Methicillin-resistant Staphylococci are behind these four letters. Krämer is arguing the case for the careful use of antibiotics. They must be prescribed correctly and in a controlled and targeted manner.

“The number of post-operative wound infections can be halved by a single, perioperative antibiotic prophylaxis administered where indicated and at the right time; further measures reduce the number by more than 60 percent.” In Germany alone 2,000 metric tons of antibiotics are consumed every year. Elisabeth Meyer and her colleagues from the Charité University Hospital in Germany also report on the number of resistant bacteria rises year on year.
Berlin published this figure two years ago. The scientists wrote in the *International Journal of Medical Microbiology* that the consumption follows an 85/85/85 principle: 85 percent of antibiotics are administered in animals, 85 percent of antibiotics used in human medicine are prescribed in an outpatient setting, and 85 percent of the antibiotics used in hospitals are prescribed on non-ICU wards.

In mid-2015 the Federal Government published its German Antibiotic Resistance Strategy 2020 in order to continue and intensify the efforts launched in 2008. “The global spread of antibiotic resistance must be halted,” said Federal Health Minister Hermann Gröhe. “If antibiotics no longer work, there is a risk that treatment options will return to pre-penicillin times – with dramatic consequences,” he continued. “Clear rules governing the use of antibiotics in medicine and animal husbandry are needed, but we must also continue to research and develop new antibiotics, alternative therapy methods, and fast diagnostics tests.”

**Zero tolerance of poor hygiene**

Careful use of antibiotics prevents even more pathogens from becoming resistant. However, chains of infection are also broken by good hygiene measures. Since ever fewer health professionals are looking after ever more sick people, medical and care duties increase, leading to a higher risk of poor hygiene. “We need a multi-barrier strategy where all measures are inextricably intertwined,” says hygiene expert Kramer and goes on to name a series of measures. These include systematic hand disinfection, quality-assured reprocessing of instruments, equipment, and textiles, and the proper disinfection of surfaces particularly close to patients.

The Commission for Hospital Hygiene and Infectious Disease Prevention at the Robert Koch Institute has drawn up a list of recommendations to prevent hospital-acquired infections and these are binding for hospitals. The focus is on measures to prevent infections in the areas of care, diagnostics, and therapy, including special risk groups, risk-adapted screening for multidrug-resistant pathogens, the resulting preventive measures, and the surveillance of hospital-acquired infections.

Since the chain of infection should be broken in as many places as possible, Kramer is also calling for patients to be involved. It is important to explain to them the value of regular hand hygiene and what they can do to ensure that they do not pass on pathogens. Furthermore, Greifswald University Hospital has also introduced risk-adapted screening for multidrug-resistant, gram-negative bacteria when admitting new patients. “Since not every patient can be tested for a possible infection when they are admitted, we get them to answer 15 questions,” says Kramer. “We use the answers to draw up a risk profile and then screen the high-risk patients.”

Also desirable would be more extensive training of medical students. To this end, however, the teaching at the universities would have to be bolstered once again. After all, 15 hygiene chairs have been closed over the course of the last 20 years. There are no easy solutions to prevent hospital-acquired infections and the associated outbreak of pandemics. The problems must be addressed in a determined and concerted manner – in every single hospital, in every country, and on the global political stage.

**What is Dräger’s contribution?**

The Lübeck-based technology company produces medical products which come into direct contact with patients. They have to be properly reprocessed after use. “Over the years we have carried out intensive work on the quality-assured reprocessing of our products,” says Ernst-Wilhelm Schubert, global marketing manager at Dräger. “And we have conducted more than 20,000 individual studies in our test center, tested more than 40 disinfectants, and carefully examined several dozen materials. We subsequently drew up recommendations for quality-assured reprocessing, which are now supplied with every operating manual and also apply to equipment already being used by our customers.” Meanwhile, Dräger has also become a point of contact for many hospitals when it comes to hygiene matters. “More and more hospitals want to know how a ventilator or medical product must be reprocessed after coming into contact with a patient with an infection not usually seen in Germany, such as Ebola or MERS-CoV,” says Schubert. There is also increasing demand for integral hygiene concepts. In addition to the reprocessing of equipment, these also include the use of disposable products and the training of staff. There is even a hygiene plan for service and sales employees.
Hanging by a Thread

The shorter the amount of time a fetus develops in the womb, the more severe the premature’s child impairment can be – and sometimes the impairment lasts a lifetime. A look at the threshold between love and hope, between medical knowledge, technology, and financial constraints – including a young father’s photos of his daughter, who was born 16 weeks premature, from her birth to her first birthday.

Nothing is as precious as time. And seldom is this saying as true as during a high-risk pregnancy. A great deal is gained with every day that passes with the unborn child remaining in the natural place of development. Few areas of medicine are associated with as many challenges and difficult decisions as those in the care of premature babies. If the fetus manages to remain and grow in the womb 25 weeks after conception, then medical treatment, due to the progress in the area of neonatology in recent decades, can be really effective. The chances of survival are very good, as is the prognosis for a healthy life – even though it is still 15 weeks short of a normal gestation.

The latest significant study, published in May 2015 in the New England Journal of Medicine, stresses the immense value of time: There is only a slight chance of survival for babies born 22 and 23 weeks after gestational age, despite intensive therapy. Although a quarter and a third (respectively) of the most premature babies lived for at least a year and a half thanks to such therapy, they often had lasting impairments. Just nine percent of those born in week 22 later went on to be completely healthy; the figure was 16 percent for those born in week 23. The prognosis improves with every extra day of pregnancy.

Medicine has learnt that the development of the lungs can be accelerated with steroids; growth is promoted with the natural surfactant protein. Medico-technical machines such as the Dräger Babylog VN500 can provide optimal ventilation and are constantly learning to let their charges take over.
Visitors! Her sister Esme touches Edie for the first time 27 days after her birth. Due to an infection, Edie came into the world 16 weeks too early at St. Peter’s Hospital in Chertsey, around 45 kilometers southwest of London. Edie weighed just 570 grams when she was born and was in such a poor physical condition that some people only estimated a five to ten percent chance of her survival. The prognosis was naturally very difficult news for her parents – they didn’t know how much time they had left with Edie. Her father, David, began his photo diary into the unknown, but with the hope of having documented his daughter’s battle to stay alive.
Having families close by on the unit is normal nowadays – it’s a new trend

with their own faculties when the right moment comes. However, medical technology also knows that the lines are sometimes blurred on the threshold between life and death, right and wrong, help and suffering. The questions raised are tough: How does a premature baby weighing 500 grams cope with repeated resuscitation? And would the baby even want it? All attempts to provide standard answers have failed. Our very different global society no longer has a center from where one god or all-powerful legislator can deliver justice in each individual case by applying general rules. This is also the reason why the area of medicine follows guidelines rather than fixed laws and places its trust in the conversation that takes place between the parents and doctors. Claudia Roll also does this. The professor of neonatology and pediatric intensive care medicine works as head consultant at the children’s hospital in Datteln.

What can, may, and should medicine do?
Do parents have enough time to make some of the most difficult decisions as premature birth is approaching? Claudia Roll’s reaction to this question

Day 38: A cuddle is hugely important for the development of premature babies – and their relationship to the parents. Even though the time spent outside the incubator is associated with risks, the benefits outweigh them. Edie is calm and relaxed the entire time.
Developmental stages

The gestational age is the term used to describe the age of the developing child. The counting begins when the egg is fertilized. From that point onwards, a distinction is made between three phases:

1. Cellular phase (up to day 16)
2. Embryonic phase (day 17 to day 60)
3. Fetogenesis (fetus) (from week 12)

The heart begins to beat from the twelfth week of pregnancy. The digestion function starts at week 18. The cerebral cortex forms shortly thereafter (weeks 20 to 24) and begins to store sensations. The respiratory system is of vital importance:

- In week 24 the alveoli form, but cannot yet develop. Surfactant, a protein which only forms from the 30th week, is needed for this. Therefore, the medical administration of surfactant and the use of drugs to develop the lungs represented a major advancement in neonatal treatment.
- A premature birth is one which occurs before the end of week 37 of pregnancy – 40 weeks are normal. Care of premature babies (from week 23 of pregnancy) is very challenging, because the kidneys and immune system, among other things, are not yet fully functional, the brain is incorrectly or insufficiently stimulated, and there is the risk of many other complications. Overall, every extra day of pregnancy is considered a bonus.

Edie is bathed for the first time 107 days after her birth – an unforgettable moment for the family. Until that point, daily body care was done using a moist cotton cloth shows the gap that exists between normal everyday life and the neonatal care unit. “If you ask me: ‘Do the parents only find out one or two weeks beforehand?’ then it is clear to me that many people find this rather short. For me, it’s a long time.” And when it is much shorter, an intensive conversation takes place with the parents-to-be about what medicine can and should do, and what it is allowed to do – so that a joint decision can be made.

The reasons why a baby comes into the world too soon are very different. Some mothers know about their high-risk pregnancy long in advance and have already spent weeks in hospital. In other cases the complications escalate extremely quickly.

The specialist perinatal centers, like those found in Germany, are places where help can be given in line with the highest medical standards. A great deal has changed there since Silke Mader gave birth to twins 18 years ago. Much of this change has come about because she and other parents fought for it. “Back then, for instance, the radio was on all day in the unit, for entertainment. There were fixed visiting times, which meant that fathers on shift work couldn’t see their children without hindrance. Many aspects were geared toward the needs and rules of the hospital. I ate sandwiches for months on end, because parents were not offered food.” There was no chair for people to sit on, no place for breastfeeding, and, above all else, no opportunity to be close to the babies to care for them intensively.

Once premature, always premature

Parents, medical professionals, and care staff got together to change these conditions. Nowadays it is normal for
On Edie’s first birthday the family of four went to Godstone Farm, a paradise for kids. It is hard to discern the struggles that Edie has been through, now that the 570-gram premature baby has grown into a lively child.

families to stay together on the unit – including by the incubator of the smallest member, day and night. Silke Mader is the cofounder and chairwoman of the European Foundation for the Care of Newborn Infants. The organization is committed to improving the care of premature babies throughout Europe – and not just while they are small. Once premature, always premature, as the saying goes. Many children remain smaller and more fragile than their peers, and in many cases very early birth leaves marks in the form of cognitive or motor impairments. Mader’s son Lukas – whose sister Lena died shortly after birth – is currently studying for his high school exams. He overcame the hurdles that stood in his way. That wasn’t always easy.

Scarcity or lethargy?
Every teacher constantly needed convincing; they sought new explanations and new powers of insight: a clever boy, but some standards, such as the ability to write neatly and quickly, were lacking. Lukas always explained to them why this was the case. “When you think that one in ten children in Germany is born prematurely nowadays and thousands are born extremely prematurely, then it’s surprising how difficult life is made for them,” says Silke Mader.

Does it come down to money? Yes, but not exclusively. In fact, many industrialized nations lack the infrastructure for children with learning difficulties and motor impairments. The far-reaching compulsory inclusion measures in schools laid down by the UN Convention on the Rights of the Child are being implemented sluggishly. Yet a lack of understanding and solidarity appears to be just as much to blame as public cutbacks. Some critics say that people in Germany would rather resort to ethical

Incredibly, some parents think that 40 kilometers to the nearest hospital is too far.
debates lasting decades than actively bring about improvements. The Federal Joint Committee, which regulates the scope of benefits provided by statutory health insurance, set high standards for those starting out in life back in 2013. In all cases it requires a Level 1 perinatal center, the highest care level with the best health professionals and facilities, for premature babies weighing less than 1,250 grams or born before 29 weeks. “In Germany there is virtually no delivery so acute that the child cannot be born in such a center,” says Professor Roll. At the same time, she finds it incredible that some parents find it inconvenient to travel 40 kilometers to the nearest hospital. International studies have shown that concentrating highly advanced medicine in specialist hospitals for premature babies significantly improves the children’s prognosis. “I would also travel 200 kilometers if I knew that my child would have ten extra IQ points – no question about it!” says Roll forcefully.

Maximum care
Since such centers are very costly due to the long period of intensive care, there is sometimes a fear that failing to provide maximum care for the premature babies could be driven by economic reasons. Are lifesaving medicines being ignored to save money? The structure of the German health care system and the latest debates tend to indicate that this is not the case. After all, hospitals have a real interest in caring for premature babies themselves.

On several occasions many smaller hospitals have successfully taken action against the Federal Joint Committee’s plans to prescribe a minimum level of care in the area of neonatal intensive care medicine. The committee’s idea follows the example of other countries which focused on optimizing a handful of centers with top medical equipment and staff to ensure quality levels are achieved.

Pushing boundaries
The mission of Silke Mader – who became an activist after being affected herself – and other parent organizations is by no means accomplished. They continue to fight to give neonatology a human face. Claudia Roll remains open-minded. She makes clear that there are no easy solutions and no universal decisions for extreme emergencies: Therapy at any price is no humane strategy. On the other hand, she knows that there is no red line at which innovative medical progress stops once and for all: “When I started out, people were saying ‘Oh, 24 weeks, that can’t be done!’ Now they are saying ‘22 weeks, that can’t be done!’ And now when I see how many children born at 24 weeks are thriving, I am horrified that people used to say that! But I also know that there are quite a lot of tragic cases on the threshold of viability.” Parents have different opinions on whether they should expect their child to be exposed to such a risk. However, unlike before, their stance is now accepted by doctors. This is also medical progress.

What the law says
National legislations have a major influence on how premature babies are treated. These are the findings of international studies. The decision as to whether to resuscitate in the case of a very bad prognosis is more strongly driven by the fear of litigation in the USA compared to Europe. At the other end of the spectrum are countries like the Netherlands, where very early, highly intensive therapy is refused if the prognosis is too bad – here, it is not so much the will of the legislature that serves as a guide for medical practice, but rather a broad ideological consensus.

In Germany, state guidelines give parents and doctors broad discretionary powers to decide on the extent and type of treatment on an individual basis. Beyond dispute, however, is the fundamental standard: Every premature baby has a personal right to life, support, protection, and physical integrity. Decisions relating to the baby’s life and health should therefore not be arbitrary, but geared toward his or her welfare. However, this also requires that when a prognosis appears to be unpromising according to the best medical knowledge, doctors can and should refrain from administering life-prolonging therapy – meaning there is no absolute duty for them to provide treatment. Medical bodies have drawn up guidelines to establish a framework for those making a joint decision on treatment. These guidelines not only outline the latest medical knowledge, but also the most recent legal standards.
Rudolf Augstein’s account of the inferno was highly personal. “When the winds got up in northern Germany, when the warm summer wind blew through the burning forests, the fire became unpredictable,” wrote the Spiegel founder, reporting on the major heath fire which destroyed several thousand hectares 40 years ago. He dramatically describes the dynamics of the fire, which was fueled by huge amounts of deadfall – 2,000 hectares of forest were destroyed in this way on August 12, 1975 alone. In the same year around 8,000 hectares of forest burned down on the heath. That is a large area by German standards, where there have been around 1,100 forest fires on average spread across an area covering on average 720 hectares. In addition, there are also the “open country” fires (heathland, grass, and field fires), which are thought to be on a similar scale. When compared globally, the heath fires are dwindling: Experts such as the Freiburg-based fire ecologist Professor Johann Georg Goldammer estimate that between 300 and 600 million hectares of all kinds of vegetation catch fire every year, although the ecosystems are not fundamentally destroyed. Wildfires can have a fertilizing effect on certain forms of life and landscape. Here Goldammer cites the African savannahs, which have been burning at intervals of between one and three years for thousands of years – they need the fire to survive as an ecosystem and habitat for wild and domestic animals. The risk of a wildfire getting out of control is huge. When it comes to containing it, besides a fear for one’s own life and for settlements and forests, there is also a focus on protecting nature and the climate. After all, oxidation processes release climate-damaging carbon dioxide and pump significant amounts of aerosols into the atmosphere.

“Accordingly, our aim is to fight wildfire wherever it causes damage.”
Particularly during the summer months, dry scrubland can easily catch fire – and a ground fire in a forest can quickly turn into a crown fire. The controlled use of flames helps to prevent and fight forest fires.

Text: Peter Thomas
Germany has learned lessons from the heath fire 40 years ago

the heat needed for the oxidization process (initially from a lightning strike, for instance, but mostly as a result of human action). The fires are increasingly more often extinguished using water, sometimes with wet chemicals in order to get to the glowing material. It is delivered by troops on foot, from fire trucks, and from helicopters and firefighting planes.

The right equipment and training

Due to the difficulty of securing a water supply in forest fire regions, firefighters have traditionally used sand to smother the flames – with a special tool such as the Bavarian sand shovel or the American firefighting shovel – or they beat down the flames (with fire beaters, which are as archaic-looking as they are effective). Firebreaks can also prevent a fire from spreading. They are made by clearing the land or through controlled back-burning, which cuts off the forest fire’s path. Such methods are also used by smoke jumpers, who parachute into difficult-to-reach terrain to fight the fire on the ground. Units of this kind were first established in the 1920s in the USSR; they have also been used in the USA since the 1930s. The Mann Gulch fire from 1949, in which thirteen comrades died, demonstrates just how dangerous their job is.

Seven people also lost their lives in the heath fire of 1975, which remains one of the biggest operations in the history of the Federal Republic of Germany. “It was not only the conflagration that was catastrophic, but also the organization of the firefighting operation,” wrote Rudolf Augstein at the time. Lessons were learned, and agile, off-road firefighting tankers were bought and modern four-channel radio equipment was introduced. “In the area of the emergency services radio, the heath fire of 1975 marked the turning point in terms of technical equipment in Germany,” says Peter Damerau, chairman of the industry association for professional mobile radio.

Forty years is a long time. Efforts to secure the right equipment and training for forest fire operations have waned. In many places, for instance, there is a lack of light work clothing, with the thickly insulated clothing for fighting fires inside buildings proving unsuitable. A good basis would be firefighting jackets and trousers that comply with parts 2 and 3 of German manufacturing and testing guidelines governing universal protective clothing for firefighters, which have a fire-resistant layer (in compliance with DIN EN 15614:2007-09, for example) and are worn with long cotton underwear. For forest fire operations this clothing should additionally be fitted with tight, closable bands on the arms and legs as well as a collar that can be turned up and closed. The clothing should be bright, because this reflects the heat radiation better than dark blue and it also makes the firefighters more visible.

Other elements also need to be adapted. Details are outlined in the book published in 2013 under the German title Standard-Einsatz-Regeln: Wald und Flächenbrandbekämpfung (Standard Operation Rules: Fighting Forest Fires and Wildfires) by Ulrich Cimolino, Jan Südmersen, Detlef Maushake (see interview on page 47), and Nicolas

Exhausted:
The tough task of battling a wildfire in Bitterroot National Forest is written all over the faces of Canadian firefighters Jennifer Boyko (left) and Blair McKenzie.
Mr. Maushake, is there a serious risk of forest fires in Germany?
Certainly not across the board, but there are definitely regions where there is a higher risk of forest fires. This particularly applies to Brandenburg and Lower Saxony, but also certain areas of Hessen. With its typical forests, the risk in Brandenburg is comparable to that of southern European states.

Where do you see the greatest need for training among fire departments in Germany?
We must create a standard and clearly ordered training structure. There is already a great deal of expertise at local level, but the fire and emergency services as a whole are not yet benefiting from this.

It comes down to fundamentals such as raising awareness among fire protection specialists and forest workers that a wildfire has a completely different dynamic to a burning building or vehicle fire.

Where did you acquire your expertise in the area of wildfires?
Among other things, through trips to the USA, where I was able to accompany local fire departments on operations during work placements at the end of the 1990s, which of course allowed me to learn a great deal about fighting forest fires as a result of the structured training. Our American colleagues are very open when it comes to sharing experiences. With the “Waldbrandteam” volunteer organization established in 2015 and made up of like-minded firefighters, we are passing on this attitude and knowledge – for instance, by organizing training courses for forest workers in Lower Saxony, for community fire departments, and for professional fire departments in Brunswick, Hildesheim, and Salzgitter. Networking activities are incredibly important for dealing with wildfires efficiently, competently, and safely.

What forest fire dangers will we see emerge around the world over the coming years?
The oft-cited link between climate change and the increase in wildfires is difficult to prove, because many other factors also play a key role. However, there will be even more extreme events in future.

Neumann – from the lightweight forest fire helmet complete with scarf (DIN EN 16471, firefighting helmet for forest fires and wildfires) to dust masks (such as the Dräger X-plore 1300/1700) or face protection with particle filters. Breathing protection must also be carried for risky situations; instead of self-contained breathing apparatus, forest firefighters tend to use breathing protection masks fitted with an ABEK-P3 filter.

Above all else, progress is needed in the area of training, particularly since forest fire operations are increasing. Fire ecologist Goldammer views climate change – which is often suspected of being the main cause of the increase in major fires – as being just one of many factors: “Extreme weather conditions such as long drought periods and rising temperatures naturally contribute to the risk, but in the Mediterranean region demographic change plays just as big a role.” There are...
Intelligent fire management for the whole world

areas which had once been cultivated over the course of the centuries and thus had little combustible material, but now lie abandoned and overgrown, and these areas have plenty of fuel for wildfires nowadays. This allows minor fires to quickly develop into major ones. Faced with these examples, the GFMC director is advocating intelligent fire management. The Freiburg-based organization is showing the whole world how this could look: The researchers are winning over African village communities as well as forest workers in Asia, political decision makers in Europe, and academic partners. Accordingly, the GFMC has also devised the International Wildfire Preparedness Mechanism (IWPM) for the United Nations – a program aimed at cross-border cooperation in the area of forest firefighting. That’s because in many countries there is still little understanding of the multifaceted role of fire in the environment.

In the future Goldammer envisages a central training establishment for firefighters and emergency services in Germany. This should help to ensure that there is a consistently high level of expertise in preventing and fighting wildfires in all federal states so that events like the heath fire of 1975 never happen again.

500 MILLION YEARS AGO FORESTS REGULARLY BURNED AND REGENERATED THEMSELVES ON THE ANCIENT CONTINENT OF GONDWANA.

TREES AND CARBON DIOXIDE

Sun, water, and carbon dioxide (CO₂) are the energy sources for trees thanks to photosynthesis. An average beech tree standing 23 meters high absorbs around 12.5 kilos of CO₂ annually. It stores the carbon and releases the oxygen back into the atmosphere. As such, all the forests in the world contain around 650 billion metric tons of carbon. When wood burns, the tree’s carbon bonds once again with the oxygen in the air and releases climate-damaging CO₂. Around one percent of the world’s forests fall victim to fires each year, releasing between two and three billion metric tons of CO₂. By way of comparison, that is around half of the 4.6 billion metric tons emitted in the 28 EU states in 2012.

CAUSES OF FIRE

Only around 5 percent of all wildfires are due to natural causes; most are caused by humans – directly or indirectly. Lightning strikes are one of the few natural causes of forest fires. A hot catalytic converter can ignite dry grass. Sparks and embers from campfires and barbecues in the open can start wildfires. It is unlikely that shards of glass start wildfires.
WHERE THE FORESTS GROW

Forests cover around 30 percent of the earth’s surface. With a good four billion hectares, there are around 600 square meters for every person on earth. The five countries with the largest forested areas are Russia, Brazil, Canada, the USA, and China – between them they have more than half of the world’s forests. Tropical forests are the most common type, covering 61 percent, followed by forested areas in the boreal and temperate zones, covering 26 and 13 percent respectively. French Guyana is 98 percent covered by forest – a world record!

Germany

In 1975

8,000 hectares of forest burned on Lüneburg Heath.

×

15,000 firefighters,

11,000 soldiers from the German Army, and other support teams were on the scene to put out the fire.

×

1,500 hectares of forest and open countryside burn each year on average in Germany.

×

600 million hectares

of forest and open country burn each year on average worldwide. This is roughly equivalent to the area of Europe.
VLADIVOSTOK is quite a distance from Moscow – and yet this Russian metropolis on the Sea of Japan offers its almost 600,000 inhabitants one of the country’s most modern hospitals.

Text: Barbara Schaefer

**R**

“Russia is vast and the Czar is far away,” according to an old Russian saying that applies to the Primorye region to this day. More than nine thousand kilometers separate the Pacific from Moscow. For the past hundred years, anyone wishing to make the journey to the capital from here had to take the Trans-Siberian Railway, which terminates in Vladivostok (in English: “Ruler of the East”). A single ticket (Platzkartny) now costs 150 euros. For that price you get to travel by train for seven days. Those who reside in Vladivostok live in a wild setting – tigers are said to roam the forests. On Sundays people like to take the number 15 bus to Russky Island, go for a swim, and have a barbecue on different sections of the beach. This has only been possible since the 1990s because the island was formerly a restricted military area. Or they take a stroll along the boardwalk of the new university grounds.

Not everybody goes to Russky Island for a holiday. It’s also the site of the region’s most modern hospital. To reach the Far Eastern Federal University Medical Center (Дальневосточный федеральный университет, Двфу, FEFU) people drive from Vladivostok across the world’s longest cable-stayed bridge. It is the same type of structure as the Golden Gate Bridge. Vladivostok is located directly across the Pacific from the California city and likes to be known as the “San Francisco of the East.” The geography of the two cities is actually very similar; both have rocky
coastlines dotted with bays and countless islands. Sometimes the fog hangs so thick and heavy over Vladivostok that the tops of the bridge pillars can no longer be seen. On Russky Island, the new university building stretches along a crescent-shaped beach that belongs to the hospital. The complex was built in 2012 for the Asia-Pacific Economic Cooperation (APEC) summit, which was held on the island and attended by 21 heads of government and politicians. The university, campus, and hospital moved into the buildings afterwards. Someone entering the medical center for the first time might initially think they were in a hotel: a lobby bathed in light, spacious reception, large-format photo art on the walls depicting white flowers on black pebbles. “The fight between good and evil,” explains one employee. Anyway, that’s how they interpret this image.

Many new things in the East

The hospital is nice and bright, but above all functional and equipped with modern technology. That is how the architecture of the hospital was designed, says Andrej Silaev, head of the intensive care unit. Although anyone who enters the hospital has to slip on blue plastic overshoes as an extra precaution, laminar air flow systems are installed here: “It comes from the ceiling, which means that no germs can build up from the floor and no dust can swirl up.” This is combined with a four-stage air purification system – which contributes to the high standards of hygiene. The entire FEFU Medical Center was designed along the lines of modern facilities in the USA and Israel – such as the system of two corridors, “one for service and one for the doctors going to the operating rooms.”

Andrej Silaev began his career in 1996 in the Primorsky regional center for anesthesiology and the intensive care unit at Regional Clinical Hospital №1 in Vladivostok and worked his way up to become head of resuscitation and intensive care. Since 2013 he has been head of the intensive care unit on Russky Island. “I had experience in heart surgery, stenting, and angioplasties of the coronary and peripheral arteries. The intensive care of patients following heart surgery was my specialty.” The multidisciplinary medical
center offered him and his team many new things. “We had quite a bit to learn with the new Dräger equipment.” For him, the biggest challenges are the neurosurgical procedures, especially those involving children. “It always moves me and pleases me when young patients who previously had very little chance of being cured can be transferred from our ward to a normal ward.”

In September 2013 the first outpatient was treated at the FEFU Medical Center; in November the first operation was performed. The hospital has 205 beds, 25 intensive care beds, and nine operating rooms. No fewer than 59 people work on the intensive care ward. Of these, 16 are doctors and all of them come from Russia. Only the head of cardiac surgery comes from Singapore.

Is it not impractical to have a hospital on an island? Silaev waves the suggestion aside. “We are not an emergency hospital. Those who come here usually have an appointment.” People get there even faster than they would to other hospitals in the city, because they drive against the flow of traffic. Anyone with a serious illness here in the Far East – as this part of Siberia is officially known – used to have to travel long distances. “We are the most modern hospital for miles around,” says Silaev.

Due to the humid climate there is a higher incidence of bronchial and pulmonary illnesses. Patients used to travel to other major cities, or flew to Singapore, Korea, or the USA – yet by 2015 the doctors here had already performed more than 5,000 operations.

Among the clinicians are also interns and students from the University of Vladivostok. “The medical faculty at the FEFU is still so young that the students are all freshmen. That is why there are so many students here from other universities, such as Pacific Medical University, Vladivostok (Тихоокеанский государственный медицинский университет). But in the not too distant future, they will also come from here. We select the best!” The hospital has 11 medical departments and specializes in diagnostics as well as neurology and neurosurgery, traumatology, orthopedics, and maxillofacial reconstructive surgery. “But we don’t make new noses here,” says the assistant to the head physician. They deal with facial plastic surgery, such as children with deformities, not cosmetic corrections.

**For a spoonful of borscht**
As a university hospital, the medical center is open to all patients. There is a set procedure for financing operations, according to Silaev. The state health insurance fund pays the greater part and people have to join the waiting list. A list of requirements has to be met for a corresponding indication. “Once they reach the top of the list, it costs nothing,” explains Silaev. Those who have made use of the hospital to date are mostly inhabitants of the region, which stretches from the state capital Khabarovsk to Kamchatka and Sakhalin. Without the state health insurance system most people here could...
barely afford a stay at the hospital. The average monthly wage is around 700 euros gross. Since 2013, the minimum wage for the entire Russian Federation has been 5,205 rubles, or around 80 euros.

At the same time, the cost of living in Vladivostok is incredibly high. At the market in the city center, where dacha owners and fishermen sell their wares, a kilo of apples costs around two euros and 50 cents, peaches cost more than six euros per kilo, and even strawberries, which thrive here, cost over two euros. People pay eight euros for a kilo of salmon. Only the ubiquitous cucumbers are available for one euro per kilo. Lunch can be bought for the equivalent of around four euros in the canteen at the university hospital. The meals are consummately Russian – from borscht (beetroot soup) and pelmeni (a kind of ravioli) to vinaigrette (potato and cucumber salad) and varenyky (stuffed dumplings).

Andrei Silaev rhapsodizes about his hometown. The state invested 21 billion dollars in the infrastructure for the APEC summit; a new airport and an ice hockey stadium were also built on Russky Island. “I was born here, I grew up here, and I studied here. Vladivostok is a dynamic city and now we have this modern hospital.” Asked about his favorite place in the city, the medical man says he only discovered it with his new job: “Quite honestly, the best view is the drive to the hospital across this grandiose bridge.” He really does say grandiosni, because “grandiose” is just one of many different borrowed words in the Russian language. Silaev says it is lovely in summer, but he really loves the winter. That is when the Pacific pushes ice floes between the city and the island with all its power. It is an unforgettable sight.

A right to free basic care

How is the state of the health system in Russia? This is a question that can be answered by DR. MARION DATHE, managing director and head of the Russian section of Interculture.de. The club was founded in 1995 as an intercultural consultancy in the area of intercultural business communication at universities in Leipzig, Chemnitz, and Jena for a number of years. She is the author of a number of publications in German and Russian on the subject of intercultural business communication.

In Russia there is a formal state health insurance system:

Does the system work for the around 143.5 million inhabitants?
Yes, I think you could say that it does. There may be a lot of contradictory statements about Russia, but if you take a closer look, you will find very good news – and it’s even official. Here are some figures on free medical care: In 2013, 29.8 million inhabitants of Russia received free medical care in hospitals. The figure was 7.6 million in day clinics and 40.6 million citizens received fast medical care.

Are there enough well-trained medical professionals?
Yes, definitely. In 2013 more than two million people worked in the health sector, with 41 doctors available for every 10,000 inhabitants.

How much does a nurse or doctor earn?
The wages are rising again. According to official statistics from the Ministry of Health in the Russian Federation, the monthly income of medical staff in the state sector has grown as follows: There was a 24 percent rise (from 2012 to 2013) for medical and pharmaceutical staff with a university education to more than 42,000 rubles (almost 650 euros) – that is equivalent to 141% of the mean income in Russia. Even mid-level employees earn around a third more, around 24,000 rubles (about 360 euros).

Is medical care assured?
All citizens in Russia have a right to basic medical care. In an international comparison, Russia has a high number of doctors and hospitals per capita. However, many people lead unhealthy lifestyles. That is why the health of the Russian population is relatively poor. The health sector was badly affected by the economic decline of the 1990s. One in three of the 7,000 hospitals in the country is now in urgent need of renovation.
The Launderette with a Difference
Dirty clothing is thrown in the wash; stubborn stains are given extra treatment. It is no different with **CHEMICAL PROTECTIVE SUITS**, except that it’s not just about cleanliness here, but also safety.

They have to be on the scene when others are kept well away behind a cordon: specialists who are called out to accidents in the chemical industry or when a truck carrying hazardous goods crashes on the freeway. Rail tank cars can also be involved in accidents and endanger people and the environment with acids, alkalis, or escaping gases.

Thanks to high safety standards this only happens very rarely. Yet when it does happen, the scene is cleaned up by specialists, mostly from fire departments. They enter the scene almost like astronauts landing on the moon – their working environment is just as hostile to life. A chemical protective suit (CPS) just a few millimeters thick protects them from gases and fumes. Like the top-of-the-range Dräger CPS 7800/7900 models, its material (e.g. “D-mex,” see also Dräger Review 109, page 48 ff.) consists of a highly tear-resistant fabric embedded in an elastomer layer that is resistant to chemicals, gases, and even cuts. It also has to be resistant to both heat and cold and mustn’t overly restrict the movements of its wearers, who are often working under tough physical conditions with breathing protection. The work can begin as soon as the gloves and boots are fitted correctly and the gastight zip has been done up.

**The work begins as soon as the work is over**

The outside of the CPS inevitably comes into contact with substances such as sulfuric and hydrofluoric acid, hydrogen peroxide, sodium chloride, or phosphine – all highly dangerous products used in the chemical industry. Or they come into contact with toxic by-products of a pyrolytic process, such as in the case of fires. Working with breathing apparatus is both a responsible and difficult job. Those who clean up after a chemical accident pro-

---

**Text:** Nils Schiffhauer  **Photos:** Dominik Asbach
Cleaning and disinfecting are sufficient after exercises

tect the health of their fellow humans and the environment, while the world of the CPS protects them. The protective suit is usually contaminated after the work has been done. Drops of hazardous chemicals remain on the outer skin, to which resins can also stick. That is why one colleague in a lighter protective suit initially sprays down another specialist returning from the scene while they are still in their sealed chemical protective suit. Only after the suit has been roughly cleaned will it then be removed according to a precisely defined plan – which is easiest with the help of a colleague and even then takes time, patience, and care. The CPS must then be sent for cleaning before it is used again. This is not only the case after spectacular accidents, but also after exercises, during which the suit is possibly not even contaminated and only has to be cleaned and disinfected.

Neoprene protects the viewing window
Professional cleaning is increasingly being outsourced to service providers. Dräger has been operating one such service point on the premises of the head office of the mine rescue company RAG Deutsche Steinkohle in Herne since the beginning of 2014. Frank Bozek established it with a small team. The sporty 50-year-old is a child of the Ruhr region. “I was an industrial fitter and spent a few years underground before coming to the head office in

Which gas? Chemical protective suits are tested for certain gases with Dräger tubes and a hand pump before cleaning

Litmus test: The pH value is checked with a test strip (above) while a connector is removed (below)
Puffed up:
The decontaminated protective suit is checked for leaks under pressure before being returned to the customer.

How the toxin attacks

Humans are pretty robust, but some substances are toxic even in small doses. Particularly dastardly are the substances that are odorless or those whose effects are delayed – this is the case with carcinogenic substances, among others. A chemical protective suit forms an almost impenetrable barrier against these substances, but also against bacteria and viruses. A prerequisite is clean breathing air, for instance oxygen from self-contained breathing apparatus, because toxins can also attack via the lungs.

Contact toxins are absorbed through the skin. These include hydrogen fluoride and hydrofluoric acid. Respiratory toxins are absorbed via the ambient air. They can cause death through suffocation – nitrogen is one such example. Fumes from acids and alkalis or ammonia, for instance, burn the airways as far as the lungs. Gases such as carbon monoxide and hydrogen sulfide, on the other hand, damage the blood, nerves, and cells. Dust like asbestos can also cause damage when inhaled.

Philippus Theophrastus Aureolus Bombastus von Hohenheim – better known as Paracelsus – knew all those years ago that the dose makes the toxin. Health-based limits (concentrations) were introduced in Germany in 2005 through the Hazardous Substances Act. Complying with the concentration values set out in the Technical Rules for Hazardous Substances (TRGS) offers protection in line with the latest technical, medical, and hygiene standards. TRGS 900 rules state the threshold limit values to which employees can be exposed during a 40-hour week without adverse health effects. TRGS 903 rules, on the other hand, list the biological threshold values in the body, up to which “the health of employees is generally not affected.”
In the end the CPS is almost like new

1996.” In 2002 he moved to Dräger – and has been commuting between Krefeld and the tiled rooms on the grounds of the Pluto mine, which was decommissioned in 1976, since the end of 2013. There, in the rented space of the head office, he has taken over responsibility for cleaning chemical protective suits from RAG Deutsche Steinkohle and expanded the service for customers throughout Germany: “We not only clean our own protective suits here, but also those of some third-party suppliers.”

In principle, it all works like a launderette. Customers begin by specifying on a checklist the CPS that needs to be cleaned and the type of contamination. The team, which often calls upon the chemist Dr. Daniel Lattner, evaluates all the data on the basis of the Dräger VOICE hazardous substances database and, if necessary, the analysis of the RAG laboratory before providing a quotation. If the customer accepts, Dräger organizes for the pre-treated protective suits to be shipped to Herne. “The suits reach us in various ways and in various kinds of packaging – from barrels and plastic containers to gastight plastic bags, there are all sorts!” says Frank Bozek. The chemical protective suits are then brought to him and his colleague Jörg Schiemichen and deposited on a stainless steel table, where – also under protection and using Dräger tubes – the hazardous substance levels at the time of receipt are measured. As soon as a suit can be unpacked, its surface is moistened and its pH value is subsequently measured using a strip of litmus paper. Its condition is then carefully inspected and the suit is taken apart. The valves are removed, for instance, so that they can be cleaned separately. However, before the suits are placed in one of the industrial washing machines, which are taller than a man, the viewing windows are protected against mechanical damage with a customized protective washing shield fitted with a neoprene cover on the inside and a padded fabric bag on the outside.

Wash, lay out, blow-dry

“Then we fold each suit and place it in the drum, where it is washed at around 60 degrees Celsius for 90 minutes,” says Bozek. If certain substances reach a set concentration level in the wastewater, they are collected in a 1,000-liter tank and treated separately at a later stage.

A suit is hung upside down by its boots to dry – some things here are reminiscent of the classic miners’ washhouse – in order to eliminate all traces of moisture by using a warm airflow for up to eight hours. This is followed by another inspection; worn parts are replaced and the suit is maintained and tested in line with the operating manual. “We check the material, all the seams, gloves, and boots. We also perform a leak test of the entire CPS and its valves, and – depending on the type – we also check the mask,” adds Bozek. If required, the company can lend customers a sealed suit while the protective suit is being cleaned, which – in the event that cleaning and sterilization is no longer economically viable – can be purchased at a discounted price.

This comprehensive service is almost unique, which is why users from across Germany now send their chemical protective suits to Herne: “They know that we work extremely diligently, that safety is of paramount importance to us, and that they get an efficient solution thanks to our experience and process optimization,” says Bozek. Does he use his experience when doing the washing at home? “No,” he admits, “my wife does that.”
At a Glance

Dräger is everywhere, also in this magazine. Here is an overview of the DRÄGER PRODUCTS in this issue – in the order they appear. Each product has a special QR code that can be scanned with a smartphone or tablet. The relevant product page will then be displayed. If you have any further questions about a product, send an e-mail with the code to: draegerreview@draeger.com

**Infinity Delta XL:** Modular monitor (310 mm, 12.2”) for flexible patient monitoring in hospital. Code: DR112#5

**Firefighting:** Training solutions in which major scenarios can be practiced. Code: DR112#14

**Polytron 7000:** Measures toxic gases and oxygen levels – can be adapted for various uses. Code: DR112#27

**Oxylog 3000 plus:** Emergency ventilator – also approved for use in airplanes and helicopters. Code: DR112#30

**Disposable articles:** Non-invasive respiratory mask, breathing system filter, ventilation tube, among others. Code: DR112#37

**Babylog VN500:** Ventilator for the therapy of premature babies and neonates. Code: DR112#38

**X-plore 1700:** Particle-filtering half-mask – for effective protection against fine dust as well as solid and liquid particles. Code: DR112#47

**Anesthesia machines:** with highly developed ventilation and monitoring functions – for individual anesthesia. Code: DR112#50

**CPS 7900:** Gastight chemical protective suit that protects against industrial chemicals, chemical warfare agents, and other substances. Code: DR112#55

**DrugCheck 3000:** Compact and fast drug tester using saliva – for five substance classes (incl. THC). Code: DR112#60
Whether in the workplace, in jails, or during traffic checks, the new Dräger DrugCheck 3000 makes it easier to search for cocaine, opiates, amphetamines, methamphetamine, and cannabis (THC), and also cuts the measurement time. In the case of THC, the most difficult substance to detect, depending on the selected measurement option the sensitivity of the device can be up to 15 ng/ml.

To perform the test the collector is removed from its holder and a saliva sample is taken from the mouth of the person being tested. The sample is taken using adhesion and capillary force. Once a sufficient amount has been collected, the red indicator ring at the tip of the collector fades. The collector is then inserted in the funnel-shaped tester opening as far as the collar, breaking the ampule containing a fluid inside the tester.

The tester must now be shaken for about 30 seconds until the red control ring fades. Gold particles coated with specific antibodies subsequently bond with any drugs in the sample. The fading control ring signals the start of the waiting/preincubation time for the measurement. Afterwards the safety tab is removed, providing a view of both test strips. The sample now flows along them: As soon as the upper control lines are visible, the test results can be read. Red lines form in the marked areas if the sample is free of drugs. After the test, which can also be conducted in potentially explosive settings, the product is disposed of. The simple and intuitive test was developed in conjunction with future users. The reliable results are based on years of Dräger expertise in the area of drug and alcohol measurement.