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Infections

Infections and Infectious Diseases

News from Science

By Michael Petersen, HP

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In recent years, our understanding of infectious diseases and the body's defenses has grown rapidly. New studies show how early and sophisticated our immune system reacts – often long before we feel the first symptoms. At the same time, new pathogens, global supply chains and resistant germs make it clear how complex and vulnerable our protection system is.

News On The Basics In The Research

How our body is prepared for the worst even with harmless infections

Even in the case of supposedly mild infections, a complex emergency program runs in the body right from the start – just as if it were preparing for a serious illness. This is shown by a new study by the Technical University of Munich (TUM) and Helmholtz [Research Institute] Munich.

The researchers discovered that our immune system produces special T cells at an early stage that were previously only known in severe, chronic infections or in tumors. The surprising thing: These so-called "exhausted" T cells – actually a sign of an exhausted immune system – are apparently created at an early stage, even in the case of mild illnesses.

Until now, it was thought that this state of "T cell exhaustion" only occurs when the immune system is in continuous use for a long time. However, the new findings show: The body apparently adapts to different scenarios at an early stage – even in the case of moderate courses of the disease. From the very beginning, it forms a wide range of different T cells, as a safety precaution, so to speak. This allows it to react flexibly: with full attack power or with a controlled retreat if necessary. [1]

Danger from the freezer: How viruses come to us via our food – and what experts are doing about it

What seems like a harmless snack can become a serious health hazard: Strawberries, raspberries or blueberries from the frozen food shelf can contain viruses that cause serious illness – especially if they come from regions where water treatment and hygiene are not up to European standards. Floods and heavy rainfall also promote the spread of pathogens such as hepatitis A and E viruses as well as noroviruses.

These fruits may have come into contact with contaminated water – either in the field through flooding or during post-harvest washing. Because freezing does not kill viruses, but rather preserves them, the danger often lurks unnoticed until consumption.

Together with colleagues from Norway and the Netherlands, the laboratory of the University Hospital in Regensburg has now been designated by the EU as an official reference center for food- and water-borne viruses. The aim is to better detect outbreaks, track chains of infection and improve diagnostics.

A single virus-contaminated berry import can trigger disease outbreaks in several EU countries. The hepatitis A virus is particularly dangerous, which can cause acute liver inflammation – known as jaundice – in adults. For people with pre-existing conditions, this can be life-threatening. [2]

Tick alarm in Germany: TBE risk higher than ever - even in winter

The first TBE cases (early summer meningoencephalitis) were reported as early as January 2025 - in the middle of winter. The reason: Thanks to mild temperatures, ticks now survive the cold season and remain active almost all year round.

The figures speak clearly for themselves: In 2024, 686 TBE cases were reported nationwide – only in 2020 there were even more with 718. Bavaria and Baden-Württemberg were particularly affected, but the disease is now spreading far beyond the previous risk areas.

A significant increase can also be observed north of the low mountain ranges – including in Saxony, Lower Saxony, North Rhine-Westphalia and even in Berlin. The risk of becoming infected is therefore no longer limited to southern Germany.

What is also worrying: Ticks with TBE viruses are now also detected in popular holiday countries such as France, England, the Netherlands and Denmark. A virus type originating from Poland has already been discovered in Saxony-Anhalt, later in Lower Saxony and recently even in the Netherlands.

How many infections actually take place remains unclear – because not every disease is detected. Studies on blood donors show that the number of unreported cases is considerable. [3]

New tick virus discovered in the Alps: Mysterious and possibly risky

A previously unknown virus transmitted by ticks is currently puzzling researchers in Europe. In a large-scale study led by the University of Veterinary Medicine Vienna (Vetmeduni), a new subtype of flaviviruses was discovered – found in diseased chamois from Austria and Italy as well as in the ticks that clung to them. The pathogen is called Alpine chamois encephalitis virus (ACEV) and has already been secured for further research in the European Virus Archive.

The special feature: ACEV is the first new tick flavivirus to be discovered in Central Europe for a long time. Until now, only one representative was known in this region – the tick-borne [early summer meningo-]encephalitis virus (TBEV), which can cause severe brain inflammation in humans and animals. Now a possible new pathogen is causing a sensation, but its effect on humans and animals is still largely unclear.

Genetic analysis of the virus shows that it is a new subtype that is more closely related to the Louping III virus from the UK than to TBEV.

How dangerous this new subtype is for farm animals such as goats or sheep, and whether humans could also be affected – for example through the consumption of raw milk products – is currently the subject of intensive research. For science, it is clear that ACEV is not only a medical mystery, but also a warning signal about how little we know about the growing variety of pathogens transmitted by ticks. [4]

How a rarely noticed cell type helps us defend ourselves against dangerous germs

In a study, a research team at Saarland University has shown for the first time how brush cells in the mucous membranes of the respiratory tract not only trigger an early alarm reaction, but also help control the targeted immune defense. Up to now we knew: Brush cells react to intruders such as *Pseudomonas aeruginosa* by releasing the messenger substance acetylcholine – the central nervous system is alerted, we cough. But that was only half the truth.

Through precise measurements using the patch clamp technique – a process that makes electrical currents in cells measurable – the research team found that brush cells also release ATP, a molecule that functions as an energy store in our bodies. However, this ATP is much more than just fuel: it is the trigger of a doubly coordinated immune response. First, it attracts non-specific immune cells that intervene quickly. At the same time, it activates dendritic cells – specialists in the immune system who specifically analyze the pathogen and set in motion a tailor-made defense.

As soon as this process is initiated, the brush cells throttle the ATP release again – a sign of how precisely the body controls its immune response [5].

"And time is pressing — because according to forecasts, resistant germs could claim as many lives in just a few years as diseases once did before the antibiotic age."

Solutions For Infectious Diseases

How clever sensors protect us from infections with antibiotic-resistant germs

More and more bacteria are developing resistance to common drugs. Infections that were once considered harmless, such as bladder infections or lung infections, are thus becoming high-risk medical cases. And time is pressing – because according to forecasts, resistant germs could claim as many lives in just a few years as diseases once did before the antibiotic age.

What makes the situation so precarious? Antibiotics are often administered before it is even clear which bacterium is causing the infection. This is because classic laboratory tests take too long in an emergency. This is exactly where researchers at EMPA (The Swiss Federal Laboratories for Materials Science and Technology) come in: Together with partners from hospitals, they are developing novel sensors that detect pathogens in record time and enable targeted treatments.

One example: In the case of pneumonia caused by the particularly stubborn germ *Klebsiella pneumoniae*, a fluorescent sensor is to be used in the future. This is being developed in the Laboratory for Biomimetic Membranes And Textiles – in cooperation with the Cantonal Hospital of St. Gallen. The trick: The bacteria produce a special enzyme called Urease. If it hits certain polymer particles in the sensor, it begins to glow. In this way, the infection can be detected quickly – with a simple sample from the throat or sputum. Instead of waiting for days, there is certainty in a few hours.

The researchers are also breaking new ground when it comes to wound infections – a hotspot for resistant germs. Together with colleagues from the clinic, they are developing an intelligent dressing. This detects dangerous pathogens such as *Staphylococcus aureus* and indicates whether the bacteria are resistant to antibiotics by color changes or glows. This is made possible by tiny sensor particles in the dressing material that react to bacterial enzymes. In this way, infections can not only be detected at an early stage, but also treated in a targeted manner – without the unnecessary use of antibiotics.

And what about germs in the urinary tract, for example due to catheter infections? This is where Empa and ETH Zurich have brought magnetic nanoparticles into play. These bind specifically to the bacterium *Pseudomonas aeruginosa*, which can then be filtered out of a urine sample by magnet. In a second step, a light signal shows whether the bacterium reacts to a certain antibiotic. The entire test takes just half an hour – and thus replaces bacterial cultures in the laboratory lasting several days. [6]

New Tool In The Fight Against Dangerous Hospital Germs

A research team at the University of Tübingen has developed an innovative laboratory tool that could be used specifically against multi-resistant bacteria – including the dreaded hospital germ *Staphylococcus aureus,* also known as MRSA. The tool, called PhARIS, makes it possible to identify exactly those viruses that can attack and destroy certain bacterial strains within a few hours.

These viruses, so-called bacteriophages, are considered a promising alternative to antibiotics – especially if the latter are no longer effective. Unlike broad-spectrum antibiotics, phages only attack their target bacteria, leaving the rest of the body's healthy microbiome intact.

But the challenge lies in the details: For successful phage therapy, the right virus for the respective bacterium must be found – so far a laborious process. This is exactly where PhARIS comes in. The system analyzes the genetic material of the phages and uses certain binding proteins to detect whether a virus can specifically infect a certain bacterial variant.
The researchers see great potential for the use of PhARIS, especially in the case of wound infections or bacterial complications around implants. In the long term, the tool will also be adapted to other pathogens in order to support laboratories worldwide in using phages as therapeutic agents quickly and in a targeted manner. [7]

Hope in the fight against hepatitis E: New antibodies could prevent severe courses

In most cases, infection with the hepatitis E virus (HEV) proceeds silently and unnoticed. For people with a weakened immune system, pre-existing liver diseases or pregnant women, the virus can be dangerous and trigger life-threatening liver inflammation.
Researchers at TWINCORE in Hanover and the University of Lübeck have discovered antibodies that can neutralize the virus in a targeted manner. To do this, they removed so-called memory B cells from patients after recovery – i.e. immune cells that "remember" the virus and form antibodies. Many of these antibodies were directed against the so-called capsid protein of the virus – a kind of shell that surrounds the genetic material of the HEV. This capsid is not only found in the virus particles themselves, but also in a free, soluble form in the blood. A clever strategy of the virus to distract the immune system.
But this is exactly where the new therapeutic approach comes in: The researchers focused on antibodies that exclusively recognize the infectious virus – and not its "camouflage". With the help of high-resolution X-ray structure analyses, the University of Lübeck was able to show how these antibodies bind specifically to the virus and render it harmless. [8]

Textiles with built-in infection protection

In a pioneering research project, the German Institutes for Textile and Fiber Research (DITF) are working together with the technology group Heraeus on a groundbreaking innovation: Textiles that permanently stand up to pathogens – without the use of classic chemical agents.
The secret behind it is AGXX – a novel antimicrobial technology developed and licensed by Heraeus. The focus is on a mechanism of action based on a redox reaction. Tiny particles of silver and ruthenium react with humidity and produce highly reactive oxygen compounds such as peroxides. These attack bacteria, viruses, fungi and even algae – quickly and effectively.
What makes AGXX special: The particles have a permanent effect without being consumed. Unlike conventional systems, which rely on the release of silver ions and are often difficult to control or will soon no longer be permitted, AGXX remains stable – a major plus point for safety and environmental compatibility.
The researchers at DITF have set themselves the task of integrating this technology into textile materials in such a way that they remain both functional and comfortable. Whether as a coating or processed directly in the yarn – the aim is to provide medical textiles such as coats [smocks] or protective clothing with durable protection without negatively influencing their wearing properties.

The focus is on two things: On the one hand, infection protection should be as strong as possible, and on the other hand, breathability, washing resistance and durability must not suffer. Initial tests in DITF's in-house laboratories show promising results – on both polyester and polyamide fabrics. Even in synthetic fibres such as PA6 that have been mixed with AGXX, the mechanical properties of the fibres remain stable. [9]

Result

The current research results illustrate how dynamically and proactively our immune system works – and at the same time how important technological innovations are in the fight against infectious diseases. This makes it all the more important to translate scientific findings into prevention and therapy at an early stage.

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