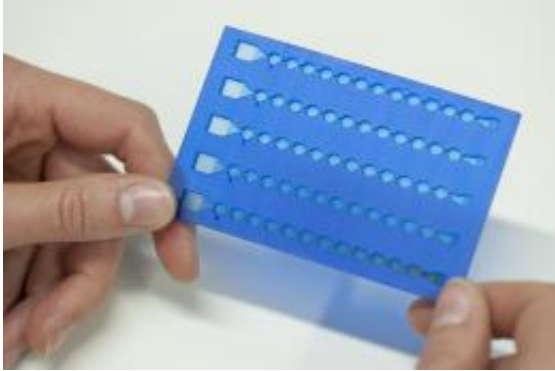


Saving lives with fast sepsis testing

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The magnetic nanoparticles transport the pathogen DNA into the detection chambers (on the right) on this plastic card. This is a prototype of the card for the fast sepsis test. Credit: Fraunhofer IZI

Blood poisoning can be fatal. If you suffer from sepsis, you used to have to wait as much as 48 hours for laboratory findings. A new diagnostic platform as big as a credit card will now supply the analysis after as little as an hour. This system is based on nanoparticles that are automatically guided by magnetic forces.

Although it is the third most frequent cause of death in Germany, [blood poisoning](#) is frequently underestimated. In this country, 60,000 persons die every year from some form of [sepsis](#), almost as many as from heart attacks. The Sepsis Nexus of Expertise states that patients arriving at the intensive care ward with blood poisoning only have a 50% chance of surviving. One of the reasons for the high mortality rate is the fact that

patients are not correctly treated due to late diagnosis. The doctor and the patient used to have to wait as much as 48 hours for the laboratory analysis.

In future, a new mobile diagnostics platform will be guaranteeing fast and low-cost infection diagnostics even while the patient is being transported to the hospital. It's called MinoLab and it consists of a plastic card the size of a credit card that is inserted in an analysis unit that is smaller than a notebook. This system provides findings in less than one hour to enable the doctor to prescribe the life-saving therapy. This is based on magnetic particles that dock onto the cells to be studied in a blood sample and run through the system fully automatically with magnetic force. At the end of the process, the [diagnosis](#) is made with magnetic sensors. MinoLab is presently being developed in a project of the German Federal Ministry of Education and Research by the Fraunhofer Institute for Cell Therapy and Immunology (IZI) in Leipzig, Germany in collaboration with Magna Diagnostics, a company hived off from the Fraunhofer Society. Other project partners are the Fraunhofer Institute for Reliability and Microintegration (IZM) in Berlin as well as the companies Siemens, Dice, microfluidic Chip Shop and the Austrian Institute of Technology.

Dr. Dirk Kuhlmeier, a scientist at the Fraunhofer Institute for Cell Therapy and Immunology, explains how all that works: "After taking a sample of blood, magnetic nanoparticles bind themselves to the target cells in the blood sample through specific catcher molecules. We then use a simple magnet to transfer the particles onto the plastic card along with the pathogens and move them through various miniaturized reaction chambers which is where the polymerase chain reaction takes place. This is a method for copying even the smallest DNA sequences of pathogens millions of times. After it is copied, the nanoparticles transport the pathogen DNA into the detection chamber where a new type of magnetoresistive biochip can identify pathogens and antibiotics

resistances.” Our researcher goes on: ”All reactions starting from sample preparation through isolating the target molecules right down to documentation are carried out without any contact and fully automatically.” This means that routine operation is made much simpler for the laboratory technician and it reduces the risk of contamination from bacteria introduced from the environment that set off false alarms. But there is another benefit, as Dr. Kuhlmeier explains: “We not only save time with the combination of magnetic nanoparticles in a new type of micro-fluid. Miniaturization means we also save expensive apparatuses.”

The experts have already been successful at using magnetic [nanoparticles](#) to isolate and document the sepsis pathogens, although Kuhlmeier says, “it will be another two years or so until we are able to produce a prototype of the diagnostic platform.” Platform technology is not only suited for sepsis tests. It will be able to back up doctors in hospitals and private practices answering a wide range of molecular biological issues ranging from genetic predisposition right down to cancer diagnostics.

Provided by Fraunhofer-Gesellschaft

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