SNAPS

Applied MedTech technologies

Microfluidic multiplex biosensor

Antibiotics lose their effect sooner or later, depending on the preparation. Every body reacts differently to antibiotics and breaks them down at different rates. In addition, the rate of antibiotic resistance is also continuously increasing, which is why antibiotic levels can only be determined by healthcare professionals through point-of-care blood tests or non-invasive samples. The research group led by Dr. Can Dincer recently presented a new approach: using a microfluid chip, it should be possible to measure the antibiotic level in the breath.

The researchers found that breath is a good alternative to blood measurement because, unlike other non-invasive samples based on sweat or saliva, blood-breath-transport happens almost directly.

How does the measurement of antibiotic levels in the breath work?

The system is based on synthetic proteins that react to antibiotics to produce a current change. The technology is a microfluidic biosensor fabricated using a dry film photoresist DFR process. This involves loading a platinum-patterned polyimide substrate with multiple DFR layers. The construct provides the prerequisite for the realisation of microchannels and electrodes.

The microfluidic biosensor consists of two complementary areas, but separated by a hydrophobic stop barrier: an immobilisation area and an electrochemical cell. The separation of the areas avoids possible electrode contamination.

The proteins attached to the polymer film are able to identify beta-lactam antibiotics. The recognised antibiotic sample then competes with an enzyme-coupled beta-lactam to bind the bacterial proteins. In the process, resistant bacteria recognise an antibiotic that is dangerous for them with the help of a natural receptor protein. The rule is: the more antibiotic is detected in the breath sample, the less of the enzyme product is produced, resulting in a lower measurable current or current change.

The microfluidic multiplex biosensor makes it possible to simultaneously measure a range of samples and test substances. In the future, the technology will support the individual dosage of drugs so that the outbreak of infectious diseases and the development of resistant bacterial strains is reduced.

RESEARCH PROJECTS TO LOOK AT:

- **Research center:** Albert-Ludwig-Universität Freiburg
- **Technological basis:** Microfluidic multiplex biosensor
- **Field of application:** Determination of the smallest antibiotic concentrations in the respiratory gas probe (correlation with blood values tested).
- **Advantages**: Faster monitoring and measurement of antibiotic levels.

  Avoidance of severe infections due to stable antibiotic levels

  Cost-effective

  Faster results (within 90 minutes)
- **Contact person:** Dr. Can Dincer; H. Ceren Ates & Prof. Dr. Wilfried Weber

State of research:

The researchers of the project have only recently tested the measurement accuracy and informative value of the technology on animals. Due to the extremely satisfactory results, clinical studies on patients are now to be started. The biosensor will then be used as a complementary instrument in everyday clinical and hospital practice.