Backgrounder

Infineon's Flow-Thru Biochips For Optical Assay Evaluation

Biochips with optical evaluation accelerate the development of drugs by up to two years

Infineon has collaborated with a MetriGenix, a specialized start-up company in the U.S., to develop a new type of optical biochip that permits assays to be performed six times faster than with conventional test methods. The main field of application of this Flow-Thru Chip™ is currently the development of new drugs. The chips are used to test substances for their effectiveness as possible drugs, in a process during the development of new drugs called screening. Due to the accelerated test phase of substances made possible by the Flow-Thru Chip, the usual 12 to 15 year development cycle for new drugs can be reduced by one or two years. This also means an accelerated approval for life-saving drugs.

In the future, it will also be possible to use the optical biochip in additional fields of application, including medical examinations, paternity testing and applications in food technology.

How Infineon's Flow-Thru biochip works

The Flow-Thru Chip is made of silicon. A special manufacturing process developed by Infineon etches about a million pores with a diameter of one tenth of a human hair within a surface of only one square centimeter. These pores are then equipped with known sections of genes, e.g. with the kind that change their genetic activity in the case of breast cancer. The gene sections attach themselves to the walls of the pores. The samples to be examined are treated with a potential active agent and then repeatedly pumped back and forth through the pores in a process that is known as Flow-Thru. Only the matching genes of the sample will bind to the gene sections on the pore wall. A luminescent dye that is added in a subsequent step will bind to the matched genes and emit light. Captured by a CCD (Charge Coupled Device) camera and forwarded to

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a computer, the light pattern can be evaluated on the screen. The analysis whether a substance is effective is fast and easy. It compares the light pattern of the healthy sample with the pattern of the treated pattern. If they match, the active agent is judged to be effective.

A fast tool for medical examinations

The early detection of diseases and an immediate, selective medication greatly enhance the success rate of therapeutic measures. The use of the biochip could in the future assist physicians in predisposition diagnostics, i. e. the detection of genetic predispositions for certain diseases. A reliable analysis result can be available on the very same day.

The chip is made of silicon and, with its about one million pores, resembles a sponge. The DNA sequences that are attached to it carry the genetic information for specific diseases. For an investigation, the DNA structure of the patient is compared to the applied DNA sequences on the chip. A match allows physicians to draw a conclusion about the existence and scope of specific genetic risk factors, e. g. susceptibility for thrombosis. With this knowledge, physicians will then be able to initiate adequate preventive measures at an early stage.

Selective medication determined in a matter of hours

Another future field of application for the optical biochip, are tests in which time is a critical factor, such as resistance analysis for germs that exist in hospitals. Hospital germs present an additional risk for patients, especially those in intensive care. Infections such as pneumonia, and inflammations of wounds or of the urinal tract, can be particularly dangerous to patients who already suffer from a weakened immune system and are resistant to a large number of known antibiotics. According to research by Heinrich Heine University in Duesseldorf, Germany, about 10,000 patients per year die of infections by multi-resistant hospital germs. Especially in the case of known dangerous infections, the time that the analysis takes can be critical. Based on the result of a resistance analysis, it is possible to determine the right antibiotic that is effective for the present resistance pattern of the germ. Within this time-critical assay, accelerated lab cycles enable a faster therapy and thus the successful treatment of the patient.

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DNA analysis for fastest identification

Similarly, the Flow-Thru Chip may be used in the future for fast and reliable determination of descent or paternity. For this purpose, the DNA structures of the individuals under examination are compared on the chip. If bindings occur, this means that significant sections of the DNA strand are identical. This could permits determination of proof of paternity with nearly 100 % reliability within a few hours.

A similar test could be applied by forensic scientist to identify individuals in criminal investigations. The analysis of the genetic information has become a major tool of law enforcement. Genetic traces at a crime site, such as hairs, saliva, blood or skin cells, can be helpful to find the individuals who committed the crimes. When DNA analysis is used to detect possible culprits among a large number of suspects, biochips can be valuable tools to analyze large amounts of data in the shortest possible period of time.

Food technology from a genetic view

The optical biochip could also provide fast answers to open questions in food technology. Using the same test setup as in the human DNA analysis, the biochip can help examine the genetic substance of food. If the analysis detects an alien DNA molecule, this clearly indicates genetically altered food products.

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