Communiqués de presse

MADE IN IBM LABS : une nouvelle sonde en silicium pour aider aux diagnostics médicaux et à la recherche de médicaments

Paris - 13 janv. 2012: Les scientifiques d'IBM Zurich ont développé une sonde microfluidique en silicium, souple et sans contact, permettant aux chercheurs et aux pathologistes d'analyser des échantillons de tissus humains afin de les aider dans la découverte de nouveaux médicaments et de faciliter les diagnostics de maladies.

La coloration des tissus est une technique très souvent utilisée en pathologie pour détecter les traces de maladies dans un échantillon de tissus provenant d'un patient. Plus précisément, une marque spécifique à chaque maladie peut être identifiée grâce à la coloration chimique des anticorps présents sur le tissu. L'intensité de la couleur permet alors de déterminer la maladie et son stade de développement.

Cependant, l'utilisation de cette technique demeure complexe et fastidieuse, d'autant que les échantillons prélevés sur les patients doivent être aussi petits que possible (quelques millimètres de longueur) afin de limiter la sensation d'intrusion souvent ressentie par les patients lors de biopsies.

«Nous sommes parvenus à une étape importante de cette technologie qui, je l'espère, fait entrer la pathologie dans l'ère moderne, servie par les derniers développements réalisés dans la microfluidique à base de silicium», commente Govind Kaigala, scientifique pour IBM Research - Zurich. «Cette nouvelle approche permettra aux pathologistes de colorer des échantillons de tissu avec une précision micrométrique et d'effectuer facilement plusieurs colorations sur des échantillons limités."

Photos disponibles à cette adresse : http://www.flickr.com/photos/ibm_research_zurich/sets/72157628678347543

***

MADE IN IBM LABS: New Silicon Probe Assists in Disease Diagnostics and Drug Discovery

- New microfluidic probe improves tissue staining for pathologists
- Flexible and more accurate, reducing the need for large biopsy samples
- Proof-of-concept puts pathology on a "modern roadmap"

Zurich, Switzerland, January 13, 2012—IBM scientists have developed a flexible, non-contact microfluidic probe made from silicon that can aid researchers and pathologists to investigate critical tissue samples accurately for drug discovery and disease diagnostics.

Tissue staining is widely used in pathology to detect disease markers in a patient's sample. More specifically, a particular disease marker is bound with an antibody, which is then chemically colored or stained on the tissue. The intensity of the color classifies and determines the extent of a disease.

Tissue staining is a tedious process with many chemical steps analogous to developing photographs, whereby excessive chemical solution or long exposures can overdevelop the sample or photograph. In the context of pathology, this can cause false positives and negatives, which can lead to misdiagnosis. According to a report issued by Johns Hopkins Hospital, of 6,171

biopsy slides that were sent from late 2008 for a second review, pathologists disagreed with the diagnosis on 86 of them.

Obtaining a biopsy is an invasive procedure for the patient, so small samples are taken whenever possible. Pathologists are determined to gain as much information as possible from these small samples, which can be only a few millimeters in length. Working at this scale requires staining to be performed on many thin slices of the sample to identify and sub-type diseases such as cancer, for treatment. Pathologists are often challenged in performing a sufficient number of important tests on these limited samples, critical for personalized treatment strategies.

“A key aspect of taking clinical samples is to ensure a high diagnostic capability while minimizing patient discomfort—the probe developed by IBM scientists does exactly that. The probe allows one to stain a very small section of a tissue with virtually any biomarker that may be clinically relevant. This capability allows the clinician to not only do more with a smaller sample, but will also allow the use of multiple stains on the same sample, therefore increasing the accuracy of the diagnosis. Thus this work may be transformative for diagnosing a variety of ailments ranging from cancer to cardiac disease,” said Prof. Dr. Ali Khademhosseini, Associate Professor at Harvard Medical School and Brigham and Women's Hospital.

To address these important challenges, IBM scientists in Zurich are reporting today in the peer-reviewed journal Lab on a Chip an innovative proof-of-concept technology called the microfluidic probe, which can accurately stain tissue sections at the micrometer scale.

The eight millimeter-wide, diamond-shaped probe consists of a silicon microfluidic head with two microchannels at each tip. Similar to an inkjet printer cartridge, the head injects the liquid on the surface, but then unlike a printer, it continuously aspirates the liquid to prevent spreading and accumulation on the surface, which can lead to overexposure.

Specifically for tissue section analysis, the probe can deliver an antibody very locally in a selected area of a tissue section with pinpoint accuracy. Since analysis can be done on spots and lines instead of on the entire tissue section, the tissue is better preserved for additional tests, if required. In addition, only a few picoliters (one trillionth of a liter) of liquid containing antibodies are needed for each analysis spot.

“We have developed a proof-of-concept technology, which I hope puts pathology on a modern roadmap—benefiting from the latest developments in silicon-based microfluidics,” said Govind Kaigala, a scientist at IBM Research - Zurich. He adds, “This new approach will enable pathologists to stain tissue samples with micrometer precision and easily perform multiple tissue stains on limited samples.”

This research is based on IBM’s decades of experience with silicon, which is now being applied to novel micro and nanotechnologies to solve today’s greatest challenges ranging from energy production and consumption to healthcare.

The microfluidic probe fits to standard workflows in conventional pathology. In addition, it is compatible with current biochemical staining systems and is resistant to a broad range of chemicals. The small size of the probe also enables easy viewing of the sample from above and below by an inverted microscope commonly used in research and clinical laboratories.

Prof. Dr. Khademhosseini said, “The developed system may have great potential in applications where sample size and the need for testing various types of biological analysis are required. I am confident that one day such approach will enable us to take small tissue biopsies and be able to obtain significantly more information.”

IBM scientists will continue to test and improve the probe and potentially begin using it in laboratory environments in the next several months. In addition, the team plans to explore specific clinical applications, possibly with partners in the field of pathology. The microfluidic probe promises to support the work of pathologists and become a tool of choice for pharmaceutical

research and diagnostics involving biological specimens.

The scientific paper entitled “Micro-immunohistochemistry using a microfluidic probe” by Robert D. Lovchik, Govind V. Kaigala, Marios Georgiadis* and Emmanuel Delamarche, appears today in Lab on a Chip, DOI:10.1039/C2LC21016A.

*Currently a PhD student at ETH Zurich, Institute for Biomechanics.

Source: Johns Hopkins Health, Fall 2010, http://www.hopkinsmedicine.org/bin/i/t/4E7A8F853E3664E4CDB181EF051A0346.pdf

---