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News Release

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Sensor chip for monitoring tumors

A chip implant may soon be capable of monitoring tumors that are difficult to operate on or growing slowly. Medical engineers at Technische Universitaet Muenchen (TUM) have developed an electronic sensor chip that can determine the oxygen content in a patient's tissue fluid. This data can then be wirelessly transmitted to the patient's doctor to support the choice of therapy. A drop in oxygen content in tissue surrounding a tumor indicates that the tumor might be growing faster and becoming aggressive.

A surgery is usually one of the first therapy options in cancer treatment. However, some tumors, such as brain tumors, can be difficult to operate on if there is a risk of damaging surrounding nerve tissue. Other cancerous tumors, such as prostate carcinoma, grow at a very slow rate and primarily affect older patients. Operating in these cases often lowers patients' quality of life without significantly extending their life expectancy.

A team of medical engineers headed by Prof. Bernhard Wolf at the TUM Heinz Nixdorf Chair of Medical Electronics have now developed a sensor chip that can be implanted close to a tumor. The sensor chip measures the concentration of dissolved oxygen in the tissue and wirelessly transmits this information to a receiver carried by the patient. The receiver forwards the data to the patient's doctor, who can then monitor the tumor's development and arrange for an operation or therapies such as chemotherapy. The tumor is thus continually monitored and the patient does not have to visit the practice or hospital as frequently for check-ups.

The sensor chip has already passed laboratory tests with cell and tissue cultures. The main challenge for the researchers was developing a sensor that functions entirely autonomously for long periods of time. The sensor must continue to function and deliver correct values even in the presence of protein contamination or cell debris. It also has to be "invisible" to the body so that it is not identified as a foreign object, attacked and encapsulated in tissue.

"We designed the sensor chip to self-calibrate to a set dissolved oxygen concentration at measurement intervals," explains engineer and project manager Sven Becker. "In addition, we enclosed the sensor chip, analysis electronics, transmitter and batteries in a biocompatible plastic housing."

Not even twice the size of a thumbnail, the sensor chip and electronics have a compact footprint. However, the package must be made even smaller before it can be implanted in cancer patients using minimally invasive surgery. In addition, the designers want to add additional sensors for measuring acidity and temperature. Also at the development phase is a miniature medication pump to be implanted with the sensor chip. The pump will be able to release chemotherapeutic agents in direct proximity to the tumor if necessary. Before moving on to the next phase, the sensor has to pass trials in

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animals. The researchers hope that the new technology will make cancer therapies more targeted and less aggressive for patients.

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Photographs:
http://mediatum.ub.tum.de/?cfold=1083187&dir=1083187&id=1083187
Caption:
Sensor chip (held between two fingers) for measuring the concentration of dissolved oxygen in tissue; the biocompatible housing (open) also contains a transmitter, analysis unit and a battery.

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