



## Tracking cancer cells using nuclear magnetic resonance (NMR)

At the Institute of Biophysics and physical Biochemistry of Professor Dr. Dr. Hans Robert Kalbitzer at the University of Regensburg, a team of researchers is using NMR spectroscopy to study the metabolism of tumor cells and to find biomarkers, i.e., measurable products e.g., as indicators for disease. The goal is to identify tumor-initiating cells, to predict their development and to facilitate targeted treatments. A BINDER KB 240 climate chamber with gas supply plays an important role in the experiment setup.

### Identifying tumor-initiating cells by non-invasive methods

Glioblastoma (GBM) is the most common malignant brain tumor in adults. Even with intensive treatment, the average survival

time is less than 15 months. A specific type of stem cell is obviously responsible for the rapid growth of this type of tumor. Therefore, the research is focused on non-invasive methods of uniquely identifying these cells, on studying their progression and on monitoring the effect of therapeutic measures. The team at the University of Regensburg relies on NMR spectroscopy (nuclear magnetic resonance) in their research.

From the outside, the NMR device looks like a very large boiler or a huge double-walled "thermos" - the superconductor that generates the magnetic field needs very low temperatures and must be cooled with liquid helium. There is a thin thread of agarose gel in which the cells have been embedded in a

### Requirements

- ▶ Precise, long-term stability of temperature
- ▶ Extremely precise control and maintenance of the gas-air-mix
- ▶ Reproducible testing results
- ▶ Comprehensive logger and controller functions for recording the test results

### BINDER solution

- ▶ KB 240 climate chamber with gas supply
- ▶ Digital temperature setting with an accuracy of a tenth of a degree
- ▶ Homogenous temperature distribution
- ▶ Gas mixing nozzle for a precise gas mix and homogenous gas distribution
- ▶ Programmable controller with intelligent temperature control and weekly program timer
- ▶ Proven and recognized validation and documentation materials
- ▶ Interface for network connection



special tube on the inside of the device during testing. The very high magnetic field (18.8 T) allows for non-invasive detection of numerous products of metabolism in the living cell with high sensitivity.

#### **BINDER climate chamber creates conditions for reproducible testing**

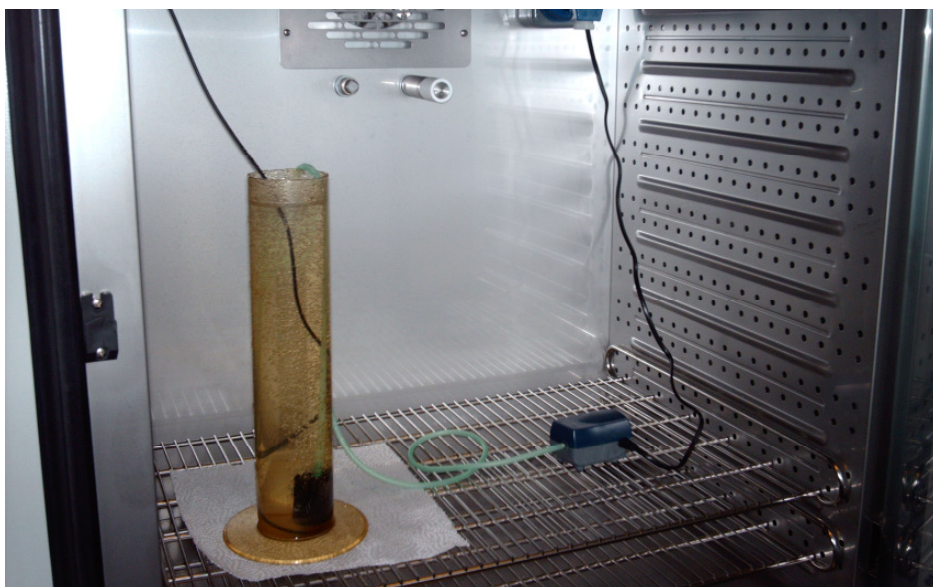
To keep the cells alive, they need an ambient temperature of 37 °C and a certain concentration of dissolved nutrients and gasses such as oxygen and carbon dioxide. The BINDER chamber comes into play here. A liquid is saturated in the chamber by supplying a precisely defined gas-air mixture at 37 °C and then during the NMR measurement, continuously fed to the cells, gasified and routed through thin hoses into the NMR or into the tubes with the stem cells. The gas mixing nozzle of the BINDER chamber ensures that the mixture

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*Paul Ramm*

*Institute of Biophysics and Physical*

is precisely maintained and that the gas is evenly distributed in the chamber. Small submersible pumps flush the medium in its container itself with the gas, thereby saturating the medium.



▲ Tube with stem cells inside the incubator

#### **Most important: accuracy**

The most important criterion in selecting the BINDER chamber was its accuracy. Even the smallest changes to the mixture of 5% CO<sub>2</sub> and a precisely defined amount of oxygen in the chamber, and the gas mixture supplied to the cells change the reaction and the results of the experiment would not be comparable.

In addition, the BINDER chamber was already well-equipped for the research in its standard version. Apart from the gas control with O<sub>2</sub> and CO<sub>2</sub>, the researchers benefit from the logging and controller function in particular, which make it possible to track long-term measurements on the spectrometer and controls on the BINDER chamber in parallel and to record the data. The

verifiability of the study results is important for publication of the results. The BINDER chamber attains particular honors in being mentioned at all points in the publications of the research results.

The research team is not just very satisfied with the BINDER unit itself. Paul Ramm of the Institute of Biophysics and physical Biochemistry says, "BINDER provided tremendous support, which was very welcome because the units had never been used before in this area and there was no previous experience."

#### **Advantages**

- ▶ Safe and reproducible incubation
- ▶ 100 °C disinfection routine
- ▶ Flexible use of external devices
- ▶ Quality „Made in Germany“

#### **Areas of application**

- ▶ Biotechnology
- ▶ Food / Beverage
- ▶ Microbiology
- ▶ Plant / Insect growth
- ▶ Oberflächentechnik



▲ Cooling incubator KB 240

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