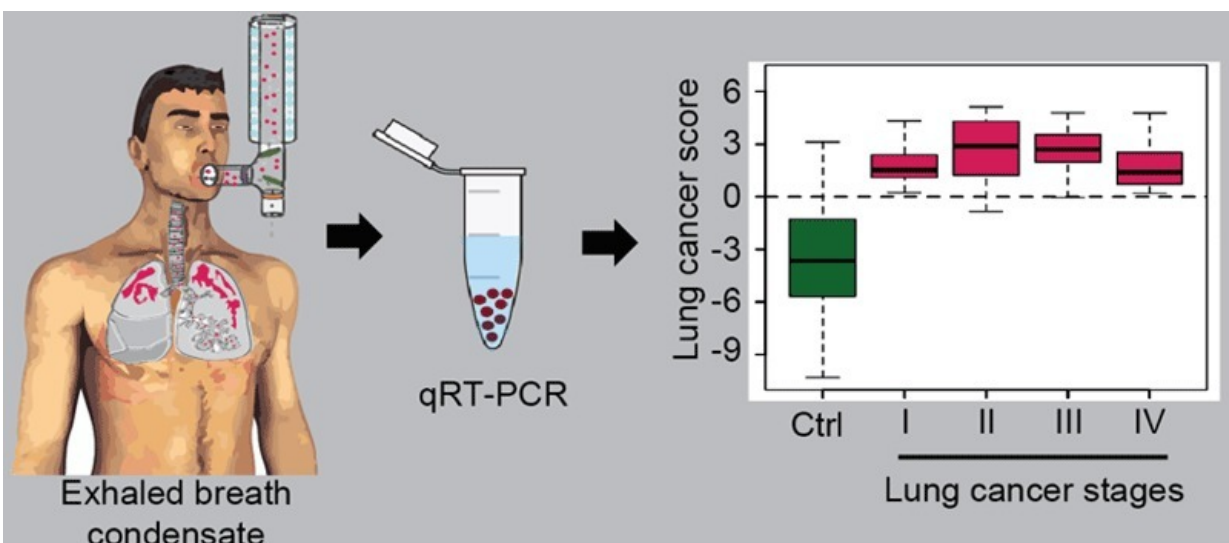


New test for early detection of lung cancer measures tiny changes in the composition of the breath

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Scientists can collect RNA molecules released from lung tissue and amplify them with the help of polymerase chain reaction (qRT-PCR). The molecules can serve as a diagnostic tool to detect cancer cells in the lungs. Credit: MPI f. Heart and Lung Research/ G. Barreto

"Inhale deeply ... and exhale." This is what a test for lung cancer could be like in future. Scientists at the Max Planck Institute for Heart and Lung Research in Bad Nauheim have developed a method that can detect the disease at an early stage. To this effect, they investigated the

presence of traces of RNA molecules that are altered by cancer growth. In a study on healthy volunteers and cancer patients, the breath test correctly determined the health status of 98 percent of the participants. The method will now be refined in cooperation with licensing partners so that it can be used for the diagnosis of lung cancer.

Most [lung cancer](#) patients die within five years of diagnosis. One of the main reasons for this is the insidious and largely symptom-free onset of the disease, which often remains unnoticed. In the USA, high-risk groups, such as heavy smokers, are therefore routinely examined by CAT scan. However, patients can be wrongly classified as having the disease.

Together with cooperation partners, researchers at the Max Planck Institute for Heart and Lung Research have now developed a [breath test](#) that is much more accurate. In their research, the diagnosis of [lung cancer](#) was correct in nine out of ten cases. The method is therefore reliable enough to be used for the routine early detection of lung cancer.

The researchers analyzed RNA molecules released from [lung tissue](#) into expired breath, noting differences between healthy subjects and [lung cancer patients](#). Unlike DNA, the RNA profile is not identical in every cell. Several RNA variants, and therefore different proteins, can arise from one and the same DNA segment. In healthy cells, such variants are present in a characteristic ratio. The scientists discovered that cancerous and healthy cells contain different amounts of RNA variants of the GATA6 and NKX2 genes. Cancer cells resemble [lung cells](#) in the embryonic stage.

The researchers developed a method to isolate RNA molecules. Not only is their concentration in expired breath extremely low, but they are also frequently highly fragmented. The researchers then investigated the RNA profile in subjects with and without lung cancer and from these

data established a model for diagnosing the disease. In a test of 138 subjects whose [health status](#) was known, the test was able to identify 98 percent of the patients with lung cancer. 90 percent of the detected abnormalities were in fact cancerous.

"The breath test could make the detection of early-stage lung cancer easier and more reliable, but it will not completely supplant conventional techniques," says Guillermo Barreto, a Working Group Leader at the Max Planck Institute in Bad Nauheim. "However, it can complement other techniques for detecting early cancer stages and reduce false-positive diagnoses."

The scientists will contribute to future large-scale clinical trials. Together with the technology transfer organization Max Planck Innovation, they are seeking licensing partners to develop the breath test to maturity and market it. They also hope to use RNA profiles for the early detection of other diseases. Tiny changes could produce tissue profiles, akin to an RNA fingerprint, that reveal diseased cells and allow for rapid treatment.

More information: Aditi Mehta et al. Non-invasive lung cancer diagnosis by detection of andisofoms in exhaled breath condensate, *EMBO Molecular Medicine* (2016). [DOI: 10.15252/emmm.201606382](https://doi.org/10.15252/emmm.201606382)

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