New technique reveals insights into lung disease

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Doctors at the Universities of Nottingham and Leicester are collaborating in the use of a magnetic resonance technique to image and quantify the air spaces inside the lungs — and the results of their research may lead to a link between childhood disease and later degenerative lung disease.

There are relatively few centres around the world which have access to this particular magnetic resonance technique, which is based at The University of Nottingham. Researchers at the University of Leicester have recruited a cohort of 10,000 children — the largest to focus on respiratory illnesses in childhood. The two research groups have combined forces, with a joint grant from the Wellcome Trust.

The method relies on the fact that certain noble gases, which are relatively rare in the atmosphere and are very un-reactive, can be detected by magnetic resonance methods when hyper-polarized in a very strong laser beam.

Tests involve individuals inhaling a very small quantity — in this case 10ml or two teaspoons — of the hyperpolarized helium-3 gas. This technique provides the key to unlock a whole new area of research in the field of lung development.

This is quite different from the magnetic resonance scans that are now commonplace in British hospitals. However, all magnetic resonance techniques function without the use of radioactive substances or ionising

radiation. They are thus very safe, have no known side effects and are ideal for research into childhood illness.

Professor John Owers-Bradley, of The University of Nottingham's School of Physics and Astronomy, said: "Nottingham's role is to undertake the MRI scans using hyperpolarised helium-3 gas and to develop software for analysis of the lung function data. Our colleagues in Leicester, led by Professor Mike Silverman, are providing a cohort of children and young people on whom a lot of data has been collected since early infancy and they are also performing the complementary lung function measurements.

"This combination of clinical and technical expertise of has created a very powerful partnership."

The pulmonary alveolus is the most peripheral structure within the air spaces of the lung, in which the gases carbon dioxide and oxygen move between the air and the blood. There are said to be about 500 million alveoli in the adult lung, and they have a combined surface area equivalent to about one tennis court. All the alveoli are formed by the age of three years, so early illnesses and exposures may leave children at risk of later lung disease.

COPD is chronic obstructive pulmonary disease, commonly known as chronic bronchitis and emphysema. This is a degenerative lung condition, enhanced by smoking, in adults beyond middle age.

Professor Owers-Bradley added: "We are seeking evidence that in young people and teenagers, the sensitive techniques that we are developing can detect differences in lung microstructure caused during fetal prenatal development, by early childhood disease or by environmental factors. For example, we have already observed the impact smoking and passive smoking on alveolar structure in an adult study which will now be

extended to teenagers.

“We aim to establish a link between the health of the lungs during childhood and later degenerative lung disease (COPD) and then seek the specific factors — genetic or environmental — which lead to defective lung development.”

Source: University of Nottingham