

New Products and Processes

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NEW SCANNING TECHNOLOGY

New scanning technology, which will give a much clearer picture of lung disease, has taken a major step forward, thanks to scientists at The University of Nottingham.

The experts at the Sir Peter Mansfield Imaging Centre have developed a process using specially treated krypton gas as an inhalable contrast agent to make the spaces inside the lungs show up on a magnetic resonance imaging (MRI) scan. It is hoped that the new process will eventually allow doctors to virtually see inside the lungs of patients.

Traditional MRI uses hydrogen protons in the body as molecular targets to give a picture of tissue, but this does not give a detailed picture of the lungs because they are full of air. Recent technological developments have led to a novel imaging methodology called inhaled hyperpolarized gas MRI that uses lasers to “hyperpolarize” a noble (inert) gas that aligns (polarizes) the nuclei of the gas so it shows up on an MRI scan.

The work will make 3D imaging using “atomic spies” such as helium, xenon, or krypton possible in a single breath hold by the patient. Nottingham has pioneered hyperpolarized krypton MRI and is currently advancing this technology toward the clinical approval processes.

Hyperpolarized MRI research has been trying to overcome a problem with these noble gases retaining their hyperpolarized state for long enough for the gas to be inhaled, held in the lungs and scanned. Now, in a paper published in the Proceedings of the National Academy of Sciences, the Nottingham team has developed a new technique to generate hyperpolarized krypton gas at high purity, a step that will significantly facilitate the use of this new contrast agent for pulmonary MRI.

Chair in Translational Imaging at the Sir Peter Mansfield Imaging Centre, Professor Thomas Meersmann said: “It is particularly demanding to retain the hyperpolarized state of krypton during preparation of this contrast agent.” We have solved a problem by using a process that is usually associated with clean energy-related sciences. It is called catalytic hydrogen combustion. To hyperpolarize the krypton-83 gas, we diluted it in molecular hydrogen gas for the laser pumping process. After successful laser treatment, the hydrogen gas is mixed with molecular oxygen and literally exploded it away in a safe and controlled fashion through a catalyzed combustion reaction.

Source: Available from: <https://www.sciencedaily.com/releases/2016/03/160310112055.htm>

HIV UPDATE

A specialized gene editing system designed by scientists at the Lewis Katz School of Medicine at Temple University (LKSOM) is paving the way to an eventual cure for patients infected with human immunodeficiency virus (HIV), the virus that causes acquired immune deficiency syndrome (AIDS). In a study published online this month in the Nature journal, Scientific Reports, the researchers show that they can both effectively and safely eliminate the virus from the DNA of human cells grown in culture.

According to senior investigator on the new study, Kamel Khalili, PhD, Laura H Carnell, Professor and Chair of the Department of Neuroscience, Director of the Center for Neurovirology, and Director of the Comprehensive NeuroAIDS Center at the LKSOM, “Antiretroviral drugs are very good at controlling HIV infection. But patients on antiretroviral therapy who stop taking the drugs suffer a rapid rebound in HIV replication.” The presence of numerous copies of HIV weakens the immune system and eventually causes AIDS.

Dr Khalili et al decided to try a different approach, specifically targeting HIV-1 proviral DNA (the integrated viral genome) using uniquely tailored gene editing technology. Their system includes a guide RNA that specifically locates HIV-1 DNA in the T-cell genome, and a nuclease enzyme, which cuts the strands of T-cell DNA. Once the nuclease has edited out the HIV-1 DNA sequence, the loose ends of the genome are reunited by the cell’s own DNA repair machinery.

Source: Available from: <https://www.sciencedaily.com/releases/2016/03/160321135535.htm>