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Press Release

Tübingen imaging scientists combine PET and MRI to observe Alzheimer's development

Researchers at the Werner Siemens Imaging Center seek tools for both, better diagnosis and evaluation of new treatments

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Neuroscientists are urgently seeking new strategies for a causative treatment of Alzheimer's disease. Yet it is just as important to find reliable procedures to evaluate the likelihood of new treatments succeeding. Researchers headed by Professor Bernd Pichler of the Werner Siemens Imaging Center at Tübingen University's Department of Preclinical Imaging and Radiopharmacy have combined two non-invasive imaging techniques, positron emission tomography (PET) and magnetic resonance imaging (MRI), enabling them to examine the proteinaceous deposits typical of Alzheimer's Disease in transgenic mice. Their study is published online in "Nature Medicine."

The genetically-modified mice developed a disease which corresponds to Alzheimer's Disease in humans. The researchers were able to follow the formation of amyloid plaques over the entire lifetime of the animals and to observe the disease's development. They were also able to document a direct connection between the formation of amyloid plaques in cerebral blood vessels with a reduced blood flow in certain areas of the brain.

The researchers examined two different lines of genetically-modified mice. In one mouse strain, amyloid plaques formed almost exclusively in the brain tissue, while in the other, they formed both in the brain tissue and in the cerebral vessels. "Only in the latter mice did we see the typical Alzheimer symptom of reduced blood flow in certain areas of the brain," said Florian Maier of the Werner Siemens Imaging Center, the study's lead author. "Our data show that the amyloid plaque buildup in the cerebral vessels is the main factor behind the disruption of blood flow," he says.

For the first time, researchers were able to obtain a high enough quality of images of live animals' brains to allow the scientists to follow the dynamics of the disease's development spatially and temporally, and also

to measure it quantitatively. The researchers were able to make greater use of the potential of PET and MRI by calibrating their parallel measurements. The researchers say this non-invasive technique could be used on human patients as well.

“We have laid the groundwork for better diagnostics, especially when it comes to distinguishing Alzheimer’s-related dementia from other diseases,” says Bernd Pichler. In addition, the study once more demonstrates that the formation of beta-amyloid plaques is a key factor in Alzheimer’s Disease. “It would make sense to develop new treatment strategies which reduce or prevent plaque formation,” says Bernd Pichler.

Publication:

Florian C. Maier, Hans F. Wehrl, Andreas M. Schmid, Julia G. Mannheim, Stefan Wiehr, Chommanad Lerdkrai, Carsten Calaminus, Anke Stahlschmidt, Lan Ye, Michael Burnet, Detlef Stiller, Osama Sabri, Gerald Reischl, Mathias Staufenbiel, Olga Garaschuk, Mathias Jucker, Bernd J. Pichler: Longitudinal PET/MRI reveals ß-amyloid deposition and rCBF dynamics, and connects vascular amyloidosis to quantitative loss of perfusion. *Nature Medicine*, advance online publication 10 November 2014, DOI 10.1038/nm.3734

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