UKE Paper of the Month (PoM)

UKE Paper of the Month January 2011

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Brown adipose tissue activity controls triglyceride clearance

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Abstract: Brown adipose tissue (BAT) burns fatty acids for heat production to defend the body against cold and has recently been shown to be present in humans. Triglyceride-rich lipoproteins (TRLs) transport lipids in the bloodstream, where the fatty acid moieties are liberated by the action of lipoprotein lipase (LPL). Peripheral organs such as muscle and adipose tissue take up the fatty acids, whereas the remaining cholesterol-rich remnant particles are cleared by the liver. Elevated plasma triglyceride concentrations and prolonged circulation of cholesterol-rich remnants, especially in diabetic dyslipidemia, are risk factors for cardiovascular disease. However, the precise biological role of BAT for TRL clearance remains unclear. Here we show that increased BAT activity induced by short-term cold exposure controls TRL metabolism in mice. Cold exposure drastically accelerated plasma clearance of triglycerides as a result of increased uptake into BAT, a process crucially dependent on local LPL activity and transmembrane receptor CD36. In pathophysiological settings, cold exposure corrected hyperlipidemia and improved deleterious effects of insulin resistance. In conclusion, BAT activity controls vascular lipoprotein homeostasis by inducing a metabolic program that boosts TRL turnover and channels lipids into BAT. Activation of BAT might be a therapeutic approach to reduce elevated triglyceride concentrations and combat obesity in humans.

Statement: Brown adipose tissue (BAT) has recently been rediscovered in humans and burns fatty acids for the production of heat in order to defend the body against cold. In the current interdisciplinary manuscript our results reveal an exciting new aspect of brown adipose tissue biology, deeply impacting the general concepts of lipid and lipoprotein metabolism. Using state-of-the-art nanotechnology we deciphered the molecular mechanism how nutrients are delivered to BAT and how activation of BAT can be used to correct elevated blood lipids and how to combat obesity. Today, obesity and elevated blood lipids represent an epidemic threat to public health and as our findings are related to every day dietary intake of lipids and how to handle their mismanagement, our study is of great importance not only for the scientific community.

The majority of the study was performed at IBMII: Molecular Cell Biology, UKE in the group of PD Dr. Joerg Heeren. It was part of the PhD thesis of Alexander Bartelt who was supported by the Ernst Schering Foundation and the DFG Research Training School 1459. Both authors have strong interest in understanding the development of obesity-induced metabolic disease such as diabetes, hyperlipidemia and NASH. The project was substantiated by close collaborations with members of the UKE radiology, the group of Prof. Weller and the imaging group of Dr. Hohenberg, HPI and is part of the Landesexzellenz Initiative "*Nanotechnology in Medicine"*.