

White, brown and pink adipocytes: the extraordinary plasticity of the adipose organ

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In mammals, the adipocyte is a lipid-laden cell forming the parenchyma of a multi-depot organ, the adipose organ. The white adipocyte stores lipids to release them, in the form of free fatty acids, during fasting, while the brown adipocyte burns glucose and lipids to perform thermogenesis. A recently characterized, third type of adipocyte does appear in the subcutaneous depot of the adipose organ of female mice during pregnancy and lactation: the pink adipocyte. The pink adipocytes are mammary gland alveolar epithelial cells with the essential role of producing and secreting milk for pup nourishment. Emerging evidence suggest that they derive from the transdifferentiation of the subcutaneous white adipocytes. Different metabolic and environmental challenges highlight the extraordinary plasticity of the mammalian adipose organ. Cold exposure leads to an increase of the “brown” component of the adipose organ to warrant thermal homeostasis. Under positive energy balance, the “white” component enlarges to a some extent to allow storage of the excess of nutrients. Finally, during pregnancy the “pink” component develops in the subcutaneous depots to satisfy pup nutritional needs. At cellular level, the plasticity of the adipose organ appears to occur not only through proliferation and differentiation of stem cells but, distinctively, *via* a direct transformation of fully-differentiated adipocytes that under proper stimuli by reprogramming their genetic expression change phenotype and, consequently, function. Understanding the transdifferentiation properties of the adipocytes is expected to offer not only new biological insights, but also possible therapeutic strategies to combat the metabolic syndrome (“browning”) and the breast cancer (“pinkening”).

Acknowledgment: supported by EU FP7 project DIABAT (HEALTH-F2-2011-278373)

Keywords

Adipose organ; obesity; transdifferentiation; mammary gland; pink adipocytes.