21 TESLA MRI MICRO-IMAGING OF RAT SKIN

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High resolution micro magnetic resonance imaging was performed on *ex vivo* samples of hairless rat skin in order to assess the capability of the ultrawide 900 MHz (21 Tesla) instrument to resolve skin features such as the viable epidermis, hair follicles, and such oil and fat-rich skin features as the sebaceous glands. Multi-contrast approaches with spatial resolution of 15 to 25 microns and slice thickness of 100 to 300 microns were utilized, and comparison of MRI results with skin histology was made. Previous images of skin samples at 500 MHz and 600 MHz were also compared to the new work at higher field.

At 21 T multiple contrast was achieved by using magnetization transfer contrast (MTC), spin–lattice relaxation (T1-weighting), and a combination of T2 and magnetic field in-homogeneity (T2*-weighting) to provide resolution up to 15 microns with distinct proton-fat contrast. SE and GE imaging were conducted by MSME_Bio and GEFC (Bruker Biospin, Billerica) methods at short TE=8 ms and TR=100, 200, 500, 1000 ms (for T1 weighted) and TE=8, 16, 24 ms, TR=1000 ms(for T2 weighted), matrix 256 x 256 with 0.3 mm slice thickness, NEX=4. The MSME_MTR sequence was used for MT images. The MRI visible skin features, including the epidermis, dermis, hair follicles and oil glands, were identified through comparison with skin histology.

At a resolution of 25μm, SE T1-weighted images provided a unique opportunity to visualize the viable epidermis and stratum corneum. However, skin hair follicles and sebaceous glands appeared gray and provided evidence of lipid rich regions. Another feature of MRI signal intensity was dependence on selection of TR. At TE=8 ms, water and lipids appeared distinct in the dermis. Other T2-weighted images showed the stratum corneum, viable epidermis, hair follicles/sebaceous glands, and dermis.

These results demonstrate the potential of MRI to characterize features in the skin and may have applications such as time series analysis of contrast transfer and the monitoring of toxicology and pharmacological properties across the skin tissue.