Magnetic resonance imaging of live pigs to assess body composition

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A magnetic resonance imaging (MRI) machine has been installed in Mariensee. The central feature of the machine is a superconducting magnet of 1.5 Tesla, cooled by liquid helium at -269°C and weighing 6250 kg. It admits a body 37 cm deep and 50 cm wide, and is therefore ideally suited for use with pigs and sheep.

One proposed use of MRI is to estimate body composition using sample scans of part of the body of live animals. Potential elite breeding stock could thus be assessed at appropriate stages of their development. To date, the most useful images have been obtained from the hip and thigh region. The advantages of choosing this region, depicted here as a series of five scans, are perceived as:

1. Less movement occurs here, because of the distance from the thorax where many heart and respiratory movements occur during the long (20 second) acquisition times necessary.

2. It is a valuable part of the carcass.

3. It contains a high proportion of muscle, the tissue that is usually being selected, and also significant and well defined proportions of bone and fat.

4. Depots of subcutaneous and intermuscular fat are depicted, and are distinct from one another. There is accumulating evidence that these fat partitions have genetic and morphological differences, and that separate measurement of each is necessary if total carcass fat is to be accurately assessed.

There are many ways of creating signals interpretable by MRI techniques. For this reason MRI has advantages over X-ray computed tomography (CT). The MRI signal in these images comes predominantly from the hydrogen nuclei (protons) in water, and is especially influenced by the association of large molecules, or by chemical interaction with fat. Some remarkable contrasts, especially between muscle and fat, are therefore possible. However, the visualisation of bone is not as simple as for X-ray CT, and careful interpretation is needed. For instance, the collagen of ligaments in these scans is indistinguishable from cortical bone. The effective use of MRI as a tool in animal breeding will likely depend on the development of special imaging techniques not necessarily useful in human medical imaging, and probably also on techniques producing body composition data direct, without the long computation times and high computer capacity necessary for image reconstruction. The installation at Mariensee, dedicated to animal production, will make such developments possible.

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