Tissue-Mimicking Phantoms for Performance Testing of 1H Magnetic Resonance Spectroscopy of Brain. Two 1H MRS head phantoms have been recently constructed using improved tissue-mimicking materials and form the basis of the author's PhD thesis. Both simulate the human head in terms of size, magnetic inhomogeneities, and MR coil loading. One phantom has been designed to simulate regions of various pathologies (Alzheimer's, multiple sclerosis, astrocytoma), with the remainder of the phantom containing material which mimics the metabolite spectra and relaxation times of normal brain as well as subcutaneous fat. The second phantom has a simulated normal brain background and contains regions which are designed to test the spatial localization, sensitivity and resolution of the MRS aspect of the MR scanner. The tissue-mimicking materials are made from a gelatin-agar base with appropriate amounts of metabolites added as well as NaCl for coil loading and thimerosal for preservation. Relaxation times of metabolic subgroups in the materials have been measured on a 1.9 T spectrometer and match those reported for *in vivo* tissue better than previous phantom materials or aqueous solutions. The phantoms have been scanned in clinical MR units and spectra match those of *in vivo* brain well. These phantoms will be of use for development of future MRS techniques and as a reference for quantitation of *in vivo* metabolite concentrations. Their anthropomorphic configuration and realistic magnetic properties make them superior to previously developed phantoms. They are currently being used in a study comparing MRS performance of different scanners.