Response

In response to Ding's comments regarding the age-dependent curve fitting, we agree that a biexponential might be better suited to fit T2 data extending into the second decade of life. However, our age range was limited to 4 years, 5 months and as clearly stated in the text, "…insufficient data from older subjects may impede the detection of a second exponential term." In addition, it is clear from Table 2 that in some regions of interest the biexponential did indeed slightly increase the quality of fit (adjusted R^2 value). However, because the fitting failed to converge in the two regions of the corpus callosum and the thalamus, for the sake of consistency we chose to use a mono-exponential fit. We also believe that different regions of interest might exhibit different age-dependent behaviors, as shown by the diffusion tensor imaging study referred to by Ding, where the genu of the corpus callosum showed a mono- rather than a biexponential decay with age (1). Another point to consider is the significant variability in T2 values for very young subjects, particularly in frontal white matter. This variability, combined with a generally low number of subjects for this age group, can limit the detection of subtle features in the fits. In any case, these are empirical fitting attempts with no theoretical underpinnings. Many other mathematical functions could have fitted the data well. These are purely descriptive functions and no theory about development depends on their validity. With regard to the acquisition method, it is well known that there are multiple components of T2 and that a two-echo calculation of T2 has limitations, in particular when done with a multislice sequence on a clinical scanner. It is unclear whether a triple-echo sequence provides significantly more accurate T2 estimates than two dual-echo sequences. In any event, because of the extensive protocol of the full study (2), the time limitations often did not even permit the second dual-echo data to be acquired. We also stress that these acquisitions, in fact, only provide pseudo-T2 values since they are based on fast spin-echo sequences. The important point is that these pseudo-T2 measurements are reproducible and reflect developmental changes in brain tissue. We believe these acquisition differences would not significantly affect the overall behavior of estimated T2 with age, particularly when considering the large change in T2 values for the age range considered.

Ilana R. Leppert, MEng
Montreal Neurological Institute
McGill University
Montreal, Quebec, Canada
E-mail: ilana@bic.mni.mcgill.ca

C. Robert Almli, PhD
Developmental Neuropsychobiology Laboratory
Departments of Neurology, Psychology,
Programs in Neuroscience, Occupational Therapy
Washington University School of Medicine
St. Louis. Missouri, USA

Robert C. McKinstry, MD, PhD
Mallinckrodt Institute of Radiology and
St. Louis Children's Hospital
Washington University Medical Center
St. Louis. Missouri, USA

Robert V. Mulkern, PhD
Department of Radiology
Children's Hospital
Harvard Medical School
Boston, Massachusetts, USA

Carlo Pierpaoli, MD,PhD
National Institute of Child Health and Human Development
National Institutes of Health
Bethesda, Maryland, USA

Micheal J. Rivkin, MD
Department of Neurology, Psychiatry and Radiology
Children's Hospital
Harvard Medical School
Boston, Massachusetts, USA

G. Bruce Pike, PhD
Montreal Neurological Institute
McGill University
Montreal, Quebec, Canada

The Brain Development Cooperative Group

REFERENCES

1. Mukherjee P, Miller JH, Shimony JS, et al. Normal brain maturation during childhood: developmental trends characterized with diffusion-tensor MR imaging. Radiology 2001;221:349–358.
2. Almli CR, Rivkin MJ, McKinstry RC. Brain Development Cooperative Group. The NIH MRI study of normal brain development (objective-2): newborns, infants, toddlers, and preschoolers. Neuroimage 2007;35:308–325.

DOI 10.1002/jmri.21928
Published online in Wiley InterScience (www.interscience.wiley.com).