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Cerefy Atlas of Brain Anatomy

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clinical neurologists and neuroradiologists, for whom the major concern is making a definitive diagnosis of MS and accurately monitoring progression and therapy, there is limited value. As the authors state in the introduction, this text will no doubt serve to stimulate new ideas and further investigations; still, it seems that in MS, it is not so much the lack of new ideas but the lack of focus of current ideas into tools that are clinically useful. For this reason, the relevance of this book to the general neurology and neuroradiology audience is somewhat limited. Few neuroradiologists have access to the advanced imaging techniques presented. Most neuroradiologists are likely to have access only to conventional MRI, but the appeal of this book may extend to the practicing neuroradiologist who would like to read more about newer techniques and how they have been applied to MS.

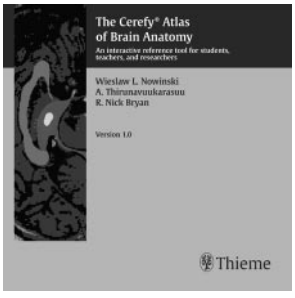
As this is a very specialized collection of chapters, there are few other texts for comparison. However, in comparison with other focused reviews, it is certainly a reasonable text with a veritable "Who's who in MS imaging research?" in the list of contributors. The audience for whom I would recommend this text and who would find it the most valuable is the neurologist and neuroradiologist with a research interest in imaging and investigating MS. For this audience, the book certainly provides a nice summary of the current work in MS.

BOOK REVIEW

Cerefy Atlas of Brain Anatomy

Wieslaw L. Nowinski, A. Thirunavuukarasuu, and R. Nick Bryan, eds. New York: Thieme Medical Publishers; 2006, Interactive CD-ROM, $69.95.

The rapid expansion of advanced functional and physiologic neuroimaging techniques is generating significant impact on the clinical neurosciences. For this development to continue, however, neuroradiologists must become facile in functional brain neuroanatomy. Techniques such as functional MRI and diffusion tensor imaging have already begun to have a significant effect on the presurgical risk assessments in patients with brain tumors and other resectable lesions. Evolving applications of brain mapping for the cognitive and neurodegenerative disorders sit close by on the horizon. Selecting appropriate treatment algorithms for stroke patients is influenced by clinical and image-based assessments of underperfused functional brain areas at risk. The integration of molecular imaging developments with other image-based functional and physiologic techniques holds great promise for the future of our field. The ability for neuroradiology to capitalize on these exciting advancements depends on our comprehension of the 3D organization of functional networks and on our capabilities of extracting information about brain pathology provided by 2D image data. This is based primarily on a thorough understanding of functional brain anatomy.



The *Cerefy Atlas of Brain Anatomy* is an electronic atlas that answers the call of functional neuroradiology training. The atlas is a CD-ROM-based interactive interface for use in neuroeducation, intended for students and residents, as well as for teachers and researchers. The atlas provides navigational capabilities in an interface of gross neuroanatomy with more than 1500 subcortical and cortical areas designated on 100 MRI images. Brain areas that are identifiable by gyral names or Brodmann's areas have been derived from the well-known brain atlas of Talairach and Toumoux and warped against MRI data using 3D Talairach transformations. Each overlaid axial, coronal, or sagittal atlas image has been warped nonlinearly against corresponding MRI sections by applying local interactive warping software. The warped atlas images have been superimposed onto MRI sections with variable blending, reshaping, and smoothing to correspond to the image data as closely as possible.

The interface is extremely user-friendly and efficient in exploring brain anatomy, including convenient features such as swapping views between axial, coronal, and sagittal planes; backward and forward operations to select the image location of interest; and a fade function that can alter the transparency of the overlaid anatomic or Brodmann's area atlas. An anatomic index uses nomenclature from the Talairach and Toumoux brain atlas and is synchronized with the main view such that pointing to or clicking on an image structure highlights the name of that structure or Brodmann's area in the index. Similarly, any structure or area clicked on in the anatomic index is highlighted in the image by blinking and changing color. In total, there are 62 subcortical structures, 31 cortical structures, and 42 Brodmann's areas identifiable in the electronic atlas. Also, a search list operation permits the user to easily find and highlight, by blinking and changing color, structures within a selected image of the main view.

The atlas application works in 2 distinct modes. First, the "Explore" mode allows the user to navigate surface or deep brain structures identified by anatomic name within the left hemisphere or corresponding Brodmann's areas within the right hemisphere on MR images. A simple right click brings forward a description of corresponding functional areas and networks. This combination of functionality is one of the best features of the electronic atlas, rapidly reinforcing the relationship between anatomy and function. Second, the "Test" mode allows the user to be tested against either the location identified on the image or by the name of an atlas structure within a compiled list. A user can be tested against the location of an atlas structure by selecting the appropriate label within the anatomic index corresponding to a highlighted structure on a given MRI section. This is extremely effective in facilitating the rapid mastery of anatomic and functional brain areas. Alternatively, users can be tested against the name of the atlas structure by clicking on the cortical or subcortical region, which corresponds to a highlighted name in the anatomic index. This latter method of testing is difficult and best suited for the more experienced individual. A score is given to each test item depending on how many attempts are required, resulting in a performance assessment.

All in all, the atlas provides a creative and efficient way to navigate anatomic structures on multiplanar MR images and to improve understanding of functional correlates. However, there are several features that significantly detract from the navigational interface. First, transformation of Talairach coordinates to the MR images is not precise, even with additional customized warping. Consequently, pointing to several locations within the brain can result in a misidentification of structures in the anatomic index. This limitation is acknowledged by the authors, who describe the atlas as an approximation of anatomic structures and Brodmann's areas on the MR images that is meant to be qualitative in presentation. This limitation significantly hinders the objective of the program. For example, in the "Explore" mode, portions of the middle frontal gyrus are designated as superior frontal gyrus in the anatomic index. Some portions of the precentral gyrus are designated as postcentral gyrus. Likewise, portions of the precuneus are identified as cuneus. The sizes of some Brodmann's areas on sections are below the margin of error of the Talairach transformation. This degree of error, if present in clinical imaging, could create catastrophic results. Consequently, the role of the electronic atlas in training neuroradiologists de novo is brought into question.

Also, the overall strategy used by the interactive interface for training users in brain anatomy relies on a one-section-at-a-time presentation of labeled structures. This provides no overall 3D framework by which a user may understand anatomic structures and functional networks within the brain. This is crucial to understanding brain functional associations and their implication to neurologic deficits. Such a 3D perspective is not only important for understanding functional brain anatomy in any plane and at any angle (including those not corresponding to the anterior commissure–posterior commissure line), but is also essential in communicating results to clinicians. The atlas requires exiting the "Label Image" function to enter the "Triplanar" feature, where identification of a structure in 3 planes can be designated by corresponding crosshairs. Consequently, a 3D appreciation of anatomical or Brodmann's areas is cumbersome. A major failing of the atlas is that it does not take advantage of sulcal landmarks in identifying cortical structures or Brodmann's areas. Identification of key sulcal landmarks is the hallmark of identifying functional anatomic regions within the brain on a case-by-case basis in clinical neuroradiology, particularly in the presence of underlying lesions that may distort anatomic relationships. For beginners, the electronic atlas fosters rote memorization of a 2D presentation of cortical gyri, subcortical structures, and Brodmann's areas without providing the basis for an understanding of 3D structures and networks that underlie the functional anatomy observed with MRI.

In summary, the *Cerefy Atlas of Brain Anatomy* is an electronic interface that is extremely clever and efficient in promoting a qualitative understanding of functional anatomic areas identified on multiplanar MR images. Imprecision of the Talairach transformation produces a margin of error that must be considered in the training of clinical neuroradiologists. The atlas is useful in training the beginning student in general anatomic and functional brain relationships and for reinforcing such relationships for the more experienced individual. For the training of radiology residents and fellows, an a priori understanding of functional anatomy is optimal. In this sense, the Cerefy atlas can serve as an effective review for neuroradiologists.

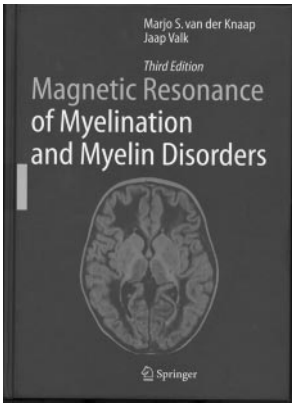
BOOK REVIEW

Magnetic Resonance of Myelination and Myelin Disorders, 3rd ed

Marjo S. van der Knaap and Jaap Valk, eds. New York: Springer; 2005, 1084 pages, 3873 illustrations, $499.

In recent years there has been immense progress in the knowledge of genetic defects, biochemical abnormalities, and cellular processes underlying myelin disorders. This progress prompted the editors of *Magnetic Resonance of Myelination* to create the third edition of this book. The editors have tried to cover most white matter disorders and to present a collection of images illustrating the field in an extensive fashion. The editors, one a neurologist and the other a neuroradiologist, have invited 13 contributors in specialized fields to write or co-write selected chapters.

The book is divided into 109 chapters. The first 4 chapters are introductory and deal with the anatomy and function of myelin disorders, selective vulnerability, and normal as well as retarded myelination. Chapter 1 has exquisite diagrams detailing the anatomy of myelin. Chapter 2 describes several classification schemes, which are a bit superfluous for most readers. The classification of leukoencephalopathies proposed by the authors would suffice as the most functional one. It divides leukoencephalopathies into hereditary disorders and acquired disorders. The hereditary demyelinating disorders are then classified according to the subcellular localization of the underlying metabolic defect, which stresses the clinical, biochemical, and neuropathologic similarities and differences between categories. The acquired demyelinating disorders are classified according to their underlying causes into noninfectious–inflammatory, infectious–inflammatory, toxic–metabolic, hypoxic–ischemic, and traumatic. The chapter on selective vulnerability (chapter 3) provides nice examples of areas predominantly involved in particular disorders. The recognition of patterns of selective vulnerability is of practical value and contributes to the diagnostic specificity of MRI interpretation. The concept of MRI pattern recognition is based on the concept of selective vulnerability. Specific brain regions may be more vulnerable to particular injuries than others. Chapter 4 deals with normal as well as retarded myelination. The chapter describes myelination and gyration patterns. It also discusses the use of diffusion-weighted imaging (DWI) and diffusion tensor imaging (DTI) to determine maturation. The images are generally good, although some of them could be larger because there are quite large blank spaces in many of the pages.



Chapters 5 through 105 describe particular leukoencephalopathies following the authors' classification scheme. The format followed in these chapters is as follows: clinical