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Book review

Laterality, the universe, and everything

McManus, I.C. (2002). *Left Hand, Right Hand*. London: Weidenfeld & Nicolson. 412pp. £20.00. ISBN 0-297-64597-8 (hbk).

When I want to annoy my colleagues, I usually inform them that all of psychology (and the sciences and humanities, for that matter) can be reduced to differences between the left and the right sides. After reading *Left Hand, Right Hand* by Chris McManus, I am starting to wonder if I might not be that far off the mark. This wonderful book takes the reader on a journey round all things that have a left and a right side. The topics covered in the book are diverse and range from asymmetries in the molecular structure of amino acids to socio-cultural interpretations of the semiotics of left and right.

The book's chapters frequently start by describing a central historical character, such as Robert Hertz (an anthropologist interested in the symbolism of left and right) or Thomas Watson (one of the first to describe the condition of *situs inversus*). At one level, these historical figures provide the vehicle for a thorough exploration of the asymmetry in question. However, the characters are also of interest in themselves and provide an insight into the process and humanity of scientific discovery. It is touching to read how Darwin, a man who has had such a profound effect on all science, was so besotted by his baby boy, describing him as a ''prodigy of beauty and intellect''. Whilst the book does have a historical flavour, it also makes use of recent research and provides the reader with a comprehensive, and up-to-date understanding of the issues under scrutiny.

At the most fundamental level, the book examines asymmetries in the structure of molecules. At the heart of all life on Earth are amino acids, which can be either left-handed, or right-handed. It just so happens that our genetic code is based entirely on left-handed amino acids. Why there should be such a predominance of these amino acids is a matter of debate—though McManus explores the particularly interesting proposition that left-handed amino acids first came to earth on the back of ''sooty black'' meteors. Maybe right-handed amino acids hitched a ride to other planets—producing ''right-handed'' life. If we were ever to visit these planets, we had better take our own food, as we would not be able to metabolise any of the right-handed proteins.

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Asymmetries in the structure of amino acids may be central to the asymmetries that occur in our bodies. McManus explores this proposition with reference to *situs inversus*, a condition where the lateral position of the viscera are reversed so that the heart is moved from the left to the right side (and the liver moves from the right to the left). The chapter that deals with this issue (*The dragon's heart*) is one of the most compelling in the book. Upon reading this chapter, it soon becomes evident how difficult, but important, it is to code left and right in the body and to establish a midline. Indeed, in individuals where there is no difference between left or right, or where the midline is not defined, the effects are disastrous. How, then, do foetal heart cells know to move slightly to the left when left/right, up/down, and front/back are essentially arbitrary in the womb? Recent research suggests that left and right may be defined in relation to the clockwise rotation of the cilia in the nodal region of the developing embryo. These rotating cilia move signalling molecules across the node so that they have their effect on the left side of the node, thus defining the midline, left, and right. And why do the cilia rotate clockwise? Because they are composed of left-handed amino acids.

From consideration of molecular and biological determinants of asymmetry, the book turns its attention to aspects of asymmetry associated with handedness and cerebral asymmetry. While McManus is probably best known for his work on the genetics of handedness, he does not dwell too long on his model. However, he does suggest that the ''D gene'', which codes for dextrality, is a mutation of the gene that codes for the lateral position of the viscera such as the heart. Thus, like the heart, asymmetries in the structure and function of the brain could be brought about by asymmetrical movements of nodal cilia during embryological development. However, while *situs inversus* is a very rare condition, sinistrality is a relatively common phenomenon, occurring at a rate of 1 in every 10 individuals. McManus argues that sinistrality occurs because there is some biological advantage in being left-handed and right hemisphere dominant. In particular, individuals with a mix of D and C genes (which code for randomness in asymmetry, and therefore sinistrality) may be at an advantage because their brain organisation departs slightly from the norm. This departure from normality may sometimes bestow a cognitive and/or motor advantage on the individual—providing some support for the idea that sinistrals are over-represented in gifted populations.

Following a discussion of hand preference, the book moves on to discuss asymmetries in function between the cerebral hemispheres. While this will be familiar ground for many readers of this journal, it does provide a nice historical background to the research and a good summary of the disorders that can occur following unilateral lesions to the left or right hemispheres. McManus argues that the basis for functional asymmetries must stem from asymmetries of the neuro-architecture of the brain—which are determined genetically. Specifically, he notes that asymmetries in the temporal/spatial coding capacities of the

hemispheres could facilitate a left hemisphere advantage for sequential time-dependent tasks and a right hemisphere advantage for processing large amounts of information simultaneously.

Left Hand, Right Hand also provides a fascinating discussion of the cultural significance of left and right. It would appear that humans suffer from an irresistible urge to classify continuous characteristics along a dichotomous scale. Thus, we are good or evil, bright or dull, a blonde or brunette. Left and right fall naturally in line with this ''dichotomania'' and are deeply entrenched in human symbolism. The importance of left and right is clearly evident in 4000 BC in the burials of the Kurgans who were neatly laid on either their left or right sides along the cardinal axes of the compass. The book argues that early symbolism of left and right was tied to the movements of the sun. Because these early cultures arose in the Northern Hemisphere, the sun would have been positioned predominantly to the south. Therefore, as one faces the rising sun, life (the sun) is to the right and death (the dark) is to the left. From this perspective, the sun also appears to move clockwise—which may explain why anti-clockwise movements are often associated with evil. I had heard how Christmas puddings should be stirred clockwise for good luck and how witches run around churches anti-clockwise. I was fascinated to hear, however, how all screws are turned clockwise to tighten them—except those on coffins, which turn anti-clockwise. Maybe this is to facilitate the loosening of the screws for those lying underneath!

Finally, two chapters are devoted to popular conceptions and misconceptions of laterality. Before the chapters start, McManus advises readers that the chapters' content is somewhat eclectic and does not quite fit with the flow of the book. While this is true, they still make enjoyable reading. It seems that people are fascinated with left and right, and are ready to ascribe a wide range of characteristics to those who are left-handed. Thus, sinistrals are more likely to be artists, delinquents, president of the United States, or homosexual, or to die young. While there is support for some of these propositions, the effects are typically very small. Perhaps, then, the most amazing thing about sinistrals is how similar they are to dextrals. Besides the paraphernalia associated with handedness, the chapters also discuss why clocks go clockwise, why mirrors only appear to reverse right and left, and why bath water spirals down the plug-hole in either direction irrespective of whether you are in the Northern or Southern Hemispheres.

The book is by no means atheoretical, and proposes a grand theory by which asymmetries at the molecular level could affect asymmetries at a biological and psychological level. By its very nature, this theory is reductionist—with all the consequent drawbacks of this approach. However, as McManus implies, asymmetry has to start somewhere and why not at the most fundamental level? The world could very well be symmetrical, but it is not. The profound asymmetries that exist at each level of explanation suggest a connection may exist between them. Whether the theory will lead to a plethora of experimental

studies is debatable. I suspect that the theory will have its greatest impact in governing how we think about asymmetry—especially at the intersections between the disciplines of chemistry, biology, medicine, and psychology.

The book brims with enthusiasm and reflects the author's keen interests in medicine, philosophy, the history of science, and psychology. It is remarkable how such a diverse range of topics are covered with such proficiency. While the issues can be quite complex, they are explained with a rich range of photographs, diagrams, and analogy. As such, the book will be of interest and accessible to a wide audience. This book is quite unlike any other that has been published on the subject of laterality and I believe that it will have a significant impact on how we view human laterality and link it to other disciplines.

MIKE NICHOLLS
Department of Psychology
University of Melbourne, Australia