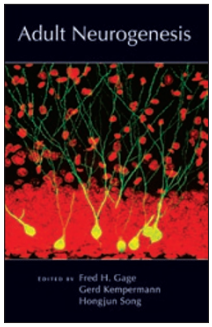
Adult neurogenesis finds its niche



Adult Neurogenesis

edited by Fred H Gage, Gerd Kempermann & Hongjun Song

Cold Spring Harbor Laboratory Press, 2008
673 pp, hardcover, $135
ISBN 9780879697846

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The study of adult neurogenesis has grown exponentially over the past decade. New papers are being published almost daily, making any attempt to summarize the field a daunting task. Nevertheless, the editors and authors of *Adult Neurogenesis* have managed to assemble a comprehensive review of current research. Organized into seven sections that encompass 30 chapters covering topics ranging from the detection of adult-generated neurons to their possible role in neurological and psychiatric disease, the book provides a truly panoramic picture. The editors acknowledge that the volume presents only a 'snapshot' of the current field (since it was released at the end of 2007, over 300 articles using the search words "adult neurogenesis" have appeared in PubMed), but its comprehensive nature makes it a valuable collection of knowledge and ideas in this burgeoning area of neuroscience.

The book begins with an extensive introduction into the *in vitro* and *in vivo* methodologies that are used to study adult neurogenesis. The importance of methodological considerations is a common thread throughout the volume, as protocol differences make comparisons of results across laboratories difficult and may contribute to certain discrepancies in the literature. The chapter on neurospheres, for example, highlights the lack of standardization of this widely used assay for detection of neural stem cells *in vitro*. Methodological concerns also plague the *in vivo* literature. In the chapters covering learning and stress effects on hippocampal adult neurogenesis, discrepant results are discussed in the context of inter-laboratory differences in BrdU labeling, histological procedures and experimental design. Thus, the volume appropriately emphasizes the need for methodological standards and advances to resolve inconsistencies and move the field forward.

Numerous major topics in adult neurogenesis are knowledgeably discussed, including cellular and molecular mechanisms, modulation by epigenetic factors, environment and neurotransmitters, as well as the function of adult-generated cells and their potential role in diseases. Each chapter was written by individuals who have made valuable contributions to the field. As with other multi-authored volumes, this style results in some repetitive presentation of introductory anatomical and technical material. Exclusion of such redundant material could have allowed space for greater depth and speculation. Along these lines, additional chapters dedicated to computational models and theoretical approaches would have helped the reader in formulating 'big picture' views of adult neurogenesis. Many chapters include a smattering of theory, with one focusing exclusively on models; nevertheless, the heavy focus on experimental work sets the stage for a follow-up volume to pull it all together.

Although the authors present a thorough overview of adult neurogenesis in the hippocampus and SVZ, the possibility of neurogenesis in other areas is only cursorily mentioned in the context of injury. Although controversial, adult neurogenesis under normal conditions has been repeatedly reported in neocortex, striatum, amygdala, hypothalamus and brainstem. Discussion of these studies would have presented a more balanced account of the literature.

The book's last chapters deal with adult neurogenesis in nonmammalian vertebrates (fish and birds), wild rodent populations and humans. These chapters are individually interesting and together raise three important points. First, adult neurogenesis is a common feature of most, if not all, vertebrates. Second, evidence does not support any evolutionary pattern regarding the rate of adult neurogenesis; it may instead be an example of convergent evolution. Rats, for example, appear to have higher rates of adult neurogenesis than bats or monkeys, yet they are phylogenetically situated between the two. Third, many studies have highlighted the sensitivity of adult neurogenesis to the environment, and therefore data from laboratory animals with limited experience may not accurately reflect the process in wild populations.

These points are highly relevant to discussions concerning the magnitude and dynamics of adult neurogenesis in humans, where quantitative data are scarce. Humans are immature at birth (particularly in comparison with monkeys), so extensive postnatal neurogenesis seems probable. People also have lives that are rich in experiences, including those that enhance neurogenesis in experimental animals. Poignantly, this monograph is dedicated to the memory of the late Peter Eriksson, who together with Fred Gage pioneered the study of adult neurogenesis in humans 10 years ago. Since then, considerable progress has been made in understanding adult neurogenesis in experimental animals, but research in humans has been hindered by the lack of noninvasive methods able to detect new neurons over time. Such tools now appear to be on the horizon – magnetic resonance spectroscopy was recently used to monitor neural stem/progenitor cells in the hippocampus of live humans (Manganas, L.N. *et al. Science* **318**, 980–985 (2007)).

Given the current explosive interest in the field, this well-organized review volume is timely. It also highlights the gaps in our current understanding of adult neurogenesis. How do new neurons integrate and interact with the pre-existing circuitry of the adult brain? What are the precise functional roles of adult-generated neurons? Can adult neurogenesis be harnessed to repair damage caused by trauma and neurological disease? With an ever-growing number of neuroscientists focusing their efforts on these questions, definitive answers will surely surface. As one of the authors, Pierre-Marie Lledo, so aptly notes in chapter 20, "the best is yet to come." ■

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