Book Reviews

From Monkey Brain to Human Brain: A Fyssen Foundation Symposium. Edited by Stanislas Dehaene, Jean-René Duhamel, Marc D. Hauser, and Giacomo Rizzolatti. xvii + 400 pp. Cambridge Massachusetts: MIT Press. 2005. $55.00 (cloth).

To unravel the complex story of human brain evolution, a thorough understanding of the comparative context anatomical structure and behavioral function is needed. Because of the complexity of the question being asked, researchers typically focus either on structure or on function, but not both (or at least only superficially refer to one or the other). The strength of *From Monkey Brain to Human Brain* is that it collects, in one place, detailed discussions of both anatomy and behavior from a variety of perspectives. The volume is the result of a symposium sponsored by the Fyssen Foundation held in June of 2003 in St-Germain-en-Laye, France.

The volume is organized into five sections. The first, titled "Human Brain Evolution: New Methods and Results," covers a variety of studies and perspectives relevant to understanding the anatomical changes that have occurred between monkey and human brains. Van Essen describes his work comparing surface-based atlases of macaque and human cortices, using deformation mapping (morphing) techniques akin to those used in functional imaging studies. His results argue, among other things, for a significantly expanded dorsolateral and dorsomedial prefrontal cortex in humans compared to macaques. Kourtzi and Logothetis review work combining electrophysiological recordings with MRI to both confirm that localized changes in oxygenated blood actually do reflect neural activity, as well as to further probe brain function. Zilles reviews work from his group comparing human and bonobo brains through deformation mapping (indicating prefrontal elaboration in humans), as well as his comparative work on neural receptor patterns in primates (suggesting reorganization of posterior parietal regions in humans compared to monkeys). Hublin surveys the paleontological evidence of brain evolution, and Changeux discusses his ideas regarding how these changes may be understood within a genetic theoretical perspective.

The second section, titled "Putative Prerogatives of the Human Brain and Their Evolutionary Precursors," focuses on the functional neuroanatomy of some specific behavioral traits. Brannon reviews work on quantitative abilities in monkeys and humans, Nieder and Miller discuss neurophysiological work probing the functional organization of numerical cognition, and Dehaene reviews research consistent with the idea that reading and arithmetic evolved through the modification of preexisting circuitry found in monkeys (what he terms the "neuronal recycling" hypothesis). Stevens and Hauser provide a critical analysis of animal studies of altruism (arguing that it may require more cognitive resources than generally recognized), and briefly review human functional imaging studies of cooperative behavior (many of which implicate prefrontal regions). Lorincz et al. review their ingenious work on 'theory of mind' in monkeys using neuron recordings and eye gaze experiments.

The third section is titled "Space, Action, and Attention: The Multiple Functions of Parietofrontal Circuits." Instead of focusing on specific behaviors, the chapters in this section review the functions of circuits in either parietal or frontal areas (and/or connections between them). Rizzolatti and Buccino summarize the mirror neuron systems in humans and primates, and review theoretical arguments regarding their possible role in language evolution. Luppino reviews work on the neuroanatomical and functional organization of the posterior parietal lobe in macaques, suggesting substantial homology with humans. Iriki reviews work on Japanese macaques combining PET and single unit neuron recordings to demonstrate adaptive changes in receptive fields in neurons that are specifically associated with tool use, suggesting a possible evolutionary precursor of tool use circuitry incipient in monkeys. Wardak et al. discuss parietal areas relevant to attentional processes in monkeys, again indicative of homologies with humans.

Section four, titled "Cognitive Control and the Frontal and Cingulate Cortices," contains two chapters covering the functional neuroanatomy of anterior regions. Petrides reviews evidence for a rostral-caudal axis of lateral frontal cortical organization in both monkeys and humans, with the most caudal areas involving sensorimotor mappings, areas slightly more rostral mediating the selection of appropriate behavior based on conditional cues, and the most rostral areas involved in monitoring information in working memory. Amiez et al.

review what is known about the comparative functional neuroanatomy of the anterior cingulate cortex, which again imply strong similarities between humans and monkeys.

The final section is titled "Visual Representations and the Temporal Lobe." Mckone and Kanwisher critically review research attempting to assess whether the special facial-recognition abilities humans show is really specific to faces, or instead simply reflects expertise for any overlearned visuospatial patterns (concluding that it is likely specific to faces). Lastly, Tanifuji et al. review their ingenious work showing that objects are represented by networks of activation among columns of cells in the inferior temporal cortex (rather than single neurons).

Most of the chapters in this volume would be appropriate for graduate students and researchers in the relevant fields (psychology, anthropology, neuroscience, etc.), and possibly high-level, motivated undergraduate students. Each chapter is self-contained with its own bibliography (rather than all citations for all papers being collected at the back of the volume in one giant list). This makes it easier to use specific chapters for, e.g., class reader course packs. There is a separate 16 page insert containing beautiful color figures from several of the chapters. However, grayscale versions of each figure are also included in the appropriate places within each chapter, nicely facilitating their use in course packs.

As with any collected volume such as this, each chapter more or less represents a particular author's personal perspective on a given issue. Some are more comprehensive reviews, while others are focused on the researchers own work. This makes it less useful as a general entrée into the topics discussed. One can certainly take issue with certain interpretations and perspectives. I would argue that some of the authors do not take an evolutionary perspective seriously enough. For example, it is quite clear that the evolutionary process is biased against the wholesale creation of completely new structures/functions. Dehaene's "neuronal recycling" hypothesis, in which human arithmetical and reading abilities are argued to be derived from pre-existing structure/functions, is clearly consistent with this principle, though he does not point this out. He also does not note that this same argument has been made many times with respect to the evolution of language (Deacon 1997; Savage-Rumbaugh and Rumbaugh 1993; Schoenemann 1999).

McKone and Kanwisher state: "...even clear behavioral evidence that objects of expertise are processed like faces would leave open the important question of whether this similarity reflects engagement of the very same mechanisms by faces and by objects of expertise, or the engagement of distinct mechanisms with similar functional properties." (p. 346). They then go on to argue that the neural evidence is equivocal on this point. They might be right, but it would nevertheless be extremely odd for species to evolve two brain mechanisms that do very similar things, without one being derived/dependent on the other. There clearly are evolutionarily more likely scenarios, and this should guide our research. Regardless, McKone and Kanwisher's critical review of the limitations of previous research on the functional neuroanatomy of face processing is extremely useful.

Stevens and Hauser discount the fact that jays can solve the Prisoner's Dilemma game (which highlights the difficulties of social living, in which there are large payoffs for 'defecting' or cheating on a partner) because they only solve it when the temptation to take an immediate benefit is removed. However, the fact that they *can* solve it means either 1) there have been enough 'natural conditions' in the past that supported it, and hence the jays have evolved mechanisms to think in these terms in the appropriate circumstances, or 2) it is not nearly as complicated as Stevens and Hauser make it out to be (the solution is not difficult given some basic logic).

Lastly, Hublin makes the all-to-common mistake of implying that brain size increases are partly explained by increases in body size in human evolution, as if brain size were tightly constrained by body size; it is demonstrably not. He also does not include any discussion of the behavioral meaning, if any, of relative brain size, leaving the mistaken impression that it is necessarily more behaviorally relevant than absolute brain size.

Nevertheless, none of these criticisms seriously detracts from the value of the volume overall. The chapters are dense, for the most part clear, and generally thought-provoking. They condense, often in very nice ways, the perspectives and research of the authors and their collaborators, and help to place this research in the broader context of the evolution of brain and behavior. This volume is clearly worth the price of admission for any-

one interested in trying to unravel the details of the evolution of the human brain given that the authors are all involved in some of the most interesting research in the area of comparative functional anatomy and neuroscience.

LITERATURE CITED

Deacon TW. 1997. The symbolic species: the co-evolution of language and the brain. New York: W.W. Norton.

Savage-Rumbaugh ES, Rumbaugh DM. 1993. The emergence of language. In: Gibson KR, Ingold T, editors. Tools, Language and Cognition in Human Evolution. Cambridge: Cambridge University Press. p 86–108.

Schoenemann PT. 1999. Syntax as an emergent characteristic of the evolution of semantic complexity. Minds and Machines 9:309–346.

TOM SCHOENEMANN
Department of Behavioral Sciences
University of Michigan-Dearborn
Dearborn, Michigan
DOI: 10.1002/ajhb.20556

Maya Children: Helpers at the Farm. By Karen L. Kramer. xviii + 254 pp. 2005. Cambridge, MA: Harvard University Press. $35.00 (cloth).

The relationship between high fertility evident in many cultures and children's economic potential was the subject of considerable debate in the 1970s and 1980s. Surprisingly, the issue is still largely unresolved. In part this is because of methodological problems inherent in measuring time use, productivity, and values. In addition, the fact that children can often be observed to be working very hard does not necessarily mean that they are net producers.

Parents in industrialized settings hardly need to be told how economically irrational having children can be. But *Maya Children: Helpers at the Farm* suggests that large families may not make sense even in societies engaged in subsistence agriculture, except for one significant factor. Children help parents, and particularly mothers, deal with the multiple challenges associated with raising multiple dependents simultaneously during the uniquely lengthy period of human parental support, ranging up to two decades.

The link between desire for and behaviors fostering more children and parental demand for child labor was the subject of a year of research by anthropologist Karen Kramer with families in a small Yucatec Maya village. A mix of scan sampling (which are alternately called spot observations by other researchers) and "focal follows" (longer behavioral observations) were designed to sample children's activities and allocation of time. Using time as a measure of productivity is problematic, however; among the many difficulties are differences in transition times and complications in calculating worth (such as comparing the value of a pound of corn vs. a pound of firewood). So Kramer also draws on experimental studies of energy expenditure. Analyzing these data graphically, she proceeds to address the apparent contradiction of children being rather costly to raise and yet still somehow key to offsetting the expenses of large families.

The Maya case reveals that net wealth flows from parents to children, countering the widely held view that farmers have many children in order to benefit from their work. However, growing households, and their associated growth in consumption, are managed by harder work not only by parents but also by increasing work by older children, who thereby help defray overall costs. The study reveals how children help with siblings as well as through self-support. Cooperation within the family, then, is a strong and effective merging of help and self-help. Results point to the significance of timing of children's contributions, as well as overall time use. The study also sheds considerable insight into the mix of dependency and assistance associated with juvenility. From an evolutionary perspective, human juvenility appears to be a prolonged time of learning that amplifies future fitness. In other words, it is time well spent on improving life's chances and not solely a matter of economic utility.

Kramer's study is an admirable effort to both measure and assess children's help. While any such measures are imprecise, the conclusions drawn seem both reasonable and worthy of further replication. Methodologically and theoretically, it suggests that while children's activities may be hard to record, or even invisible, their mercurial nature hardly connotes insignificance. It is quite the opposite. Children's help effectively resolves maternal constraints. Their labor and consumption is determined by family structure as well as size. And older children in particular help households meet the growing labor needs associated with larger numbers, especially of younger children.

A stronger sense of the social psychology of family ties would have been welcome, in order to highlight the power of learning and the growing commitment of children to the family since they are, after all, embedded not only in household production but also in intimate family relationships. In addition, children's help and their value that is closely associated with it relate not only to children's size and strength, but also to their adeptness. More attention, then, could also have been devoted to the emergence and power of family values, along with the value of children. This is how culture reinforces what their time signifies: significant additions to the production of resources necessary for household reproduction of the group, as well as ultimately themselves.

The author wisely cautions that the Maya are not representative of all small-scale agriculturalists. She also acknowledges that economic options in the Yucatán are rapidly shifting today, particularly in the form of migration to cities and wage labor, both of which strongly affect time use and in turn the costs of raising children. Similar changes worldwide, however, only increase the value of studies such as this, which build on knowledge from several related fields such as behavioral ecology, population biology, and ethnography.

James Loucky
Anthropology Department
Western Washington University
Bellingham, Washington
DOI: 10.1002/ajhb.20557

Human Biological Variation. By James H. Mielke, Lyle W. Konigsberg and John H. Relethford. xiv + 418 pp. New York, NY: Oxford University Press. 2006. $57.95 (paper).

Human biological diversity is fascinating and pertinent to those matching tissues for an organ transplant, identifying human remains, designing vaccines, reconstructing historical events, trying to understand different individual responses to medications or traumatic events. Popular conceptions of race tend to confuse. This basic primer on human variation gives the basic tools to understand the many practical applications of an understanding of human biological variation. In Section 1, entitled "Background", Chapter 1 gives the history of and controversy surrounding the race concept. The basic genetic concepts and statistics are clearly presented in Chapters 2 and 3. In Section 2, "Variation in Genes, Simple Genetic Traits, and DNA Markers" immunological variation is described starting with the classical markers, blood group and protein polymorphisms, hemoglobin variants, the major histocompatibility complex, and finishes with DNA markers. These systems are particularly interesting when discussing the evolution of diseases such as syphilis and plague, when covering the origins of the Irish Tinkers and Indo-Europeans or when trying to identify the descendants of Thomas Jefferson or who is in Jesse James' grave. Section 3 is entitled "Variation in Complex Traits" covers heritability, anthropometric and pigmentation variation and its evolution. Section 4, "Population Studies and Human Behaviors" introduces genetic distance calculations and its application to population structure. Behavioral genetics is briefly reviewed in the last chapter and this chapter includes discussions on dyslexia, sexual orientation and IQ. I would have liked some acknowledgement of the increasing impact of evolutionary approaches to human behavior and life history. The genetic bases of sexual orientation are being determined but what about sex differences? The only mention of sex difference was in regard to development, skin color and digit ratios. There are significant sex and likely age differences in responses to some medications, and the trajectories of diseases such as HIV, alcoholism and depression, to name a few. That criticism aside, this wonderful volume is highly recommended for its thorough and up-to-date coverage.

Joan C. Stevenson
Book Review Editor
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Eugenic Nation: Faults and Frontiers of Better Breeding in Modern America. By Alexandra Minna Stern. xiv + 347 pp. Berkeley, CA: University of California Press. 2005. $60.00 (cloth), $24.95 (paper).

Stern begins her introduction with the apology by Governor John Kitzhaber in December 2002 for the more than 2600 sterilizations, mostly involuntary, that occurred between 1917 and 1983 in Oregon. Five governors apologized out of the 33 states with sterilization

laws. These recent apologies highlight the importance of re-examining this issue. Many have assumed that eugenics and racial hygiene ideas died with the fall of Nazism during the 1940's but such was not the case. Prior eugenic histories also focused on the East Coast and did not describe fully the interplay between eugenic policies, the politics of reproduction and the impacts on different classes.

Chapter 1, entitled "Race Betterment and Tropical Medicine in Imperial San Francisco" opens with a description of the Panama-Pacific International Exposition in 1915 and the messages conveyed by many of the exhibits including the power of medicine during the construction of the Panama Canal and the technical supremacy of whites in Panama and in the Westward expansion to San Francisco.

Chapter 2, "Quarantine and Eugenic Gatekeeping on the U.S.-Mexican Border" details the disinfections of Mexicans at the border crossings by the U.S. Public Health Service. Foreigners were considered sources of contagion as well as inferior genes. The borders were patrolled by the often overly aggressive Texas Rangers until the Border Patrol was established in 1924. Mexicans looking for jobs became "illegal aliens".

In Chapter 3, "Instituting Eugenics in California" Stern describes how California was on the forefront of the eugenics movement in the U.S. Luther Burbank, the horticulturalist, and Stanford President, David Starr Jordan, helped establish the Eugenics Committee of the American Breeders Association in 1906. This led to the Eugenics Record Office that supported research on genetic diseases. Eugenic ideas flourished in California from 1900 to the 1940s thanks to the popularity of selective breeding on the farm and the home, discrimination against Chinese, Mexicans and Native Americans, and the numerous, diverse organizations (medical, social, educational) that were committed to eugenic goals. Concerns about mental deficiency and juvenile delinquency fostered efforts to measure who were most vulnerable by psychometricians such as Lewis S. Terman who helped develop intelligence testing. Sterilizations were encouraged legislatively in asylum and prison settings in order to improve the physical, mental or moral conditions of patients. Mexicans and Mexican Americans suffered the worst from these racist policies.

Chapter 4, "California's Eugenic Landscapes" describes the linkages between eugenicists and conservationists, such as Madison Grant and Charles Goethe, and the environmental movement exemplified by the Saving the Redwoods campaign. The contemporary environmental movement started with concerns about race suicide and initially advocated zero population growth, immigration restriction and compulsory birth control. Saving nature was inextricably tied to the "regulation of reproduction, child spacing, and the adoption of the nuclear family model" (p. 125). Efforts to turn California into a "Pacific paradise" were often built on acceptance of white supremacy.

Chapter 5, "Centering Eugenics on the Family" was the most entertaining section because Stern details how eugenicists actively promote "family values". Biotypology shifted from hierarchies to "gradated spectrums" during the post WWII period, and the American Institute of Family Relations prospered in the 1950s as the organization used popular venues and numerous pamphlets to promote family harmony and avoidance of divorce. Women were expected to make the majority of the sacrifices. She was temperamentally intermediate between baby and adult male and hence, more flexible.

The 1960s are described in Chapter 6, "Contesting Hereditarianism". Americans became dissatisfied with eugenic policies as the civil rights struggles and the women's movement spread across the country. In the Epilogue Stern laments that few are willing to share their stories about forced sterilizations in California where 20,000 sterilizations took place, one third of the national total, "something that could attach a human act to the statistics, legislative files, and unnamed patient records" (p. 211).

Stern does not discuss the biology of human variation much and probably should not, based on at least one comment about how the Hardy-Weinberg equilibrium principle "demonstrated that the overwhelming tendency of gene frequencies and ratios was to remain constant for one generation to the next" (p. 152). There seems to be an assumption that all biological variation is socially constructed and without foundation. This history is focused on European American views and the most influential personalities and policies but is a must read due to the relevance of the themes for contemporary immigration discussions. Her resources are detailed in a lengthy notes section.

Joan C. Stevenson
Book Review Editor
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Genes in Conflict: The Biology of Selfish Genetic Elements. By Austin Burt and Robert Trivers. x + 602 pp. Cambridge, MA: The Belknap Press of Harvard University Press. 2006. $35.00 (cloth).

THE BATTLE WITHIN

Some genes take advantage of the environment created by the cooperation of most of the others to advance their own rate of transmission. With their book *Genes in Conflict,* Burt and Trivers bring to the forefront this intragenomic treachery revealing that genetic incompatibilities are diverse in form, widespread in nature and perhaps most provoking is that these conflicts have significantly influenced the evolution of genomes, populations and species. To this end they have synthesized a huge body of literature with the goal of understanding all aspects of genetic conflict in eukaryotic genomes without ignoring any facet of biology where studies have been done. Much of this literature had lacked previous review. Yet, rather than editing a volume of chapters written by others they spent more than ten years synthesizing each topic and have written each chapter themselves. They have succeeded in attaining continuity in style, focus and depth such that each chapter flows smoothly into the next. At the same time special attention has been paid to ensure that each chapter can also stand alone allowing the reader to pick and choose among chapters that are of interest. In each chapter Burt and Trivers are careful to demarcate the numerous questions awaiting answer, ending the book with a summary of future directions, as well as a provocative list of host features that they propose have arisen as the result of genetic conflict.

The book is divided into 12 chapters. Chapter 1, "Selfish Genetic Elements", is the introduction to the book. Here, Burt and Trivers present their premise, that genetic elements exist that are able to increase their rate of transmission ("drive") relative to cooperative genes. They discuss 1) the mechanisms by which genetic drive is achieved: interference, overreplication and gonotaxis, 2) how selfish genetic elements spread in populations 3) their effect on the host population, 4) an overview of the history of the study of selfish genetic elements and 5) the arrangement of the book.

In Chapter 2, "Autosomal Killers" gamete or maternal-effect killers from animals, fungi and plants are described. Drive occurs in these examples either by eliminating or diminishing the viability of sperm, pollen or embryos that do not carry the driver locus or by causing a dimorphism in maternal investment in the offspring. A summary of known examples is given, including the expectation for frequency within populations due to natural selection. The evidence for each phenomenon is synthesized to develop plausible mechanisms for how this drive occurs, which are often tantalizingly speculative.

The subject of "Selfish Sex Chromosomes" is presented in Chapter 3 using a number of detailed examples from both dipteran insects and murine mammals. Relevant background information is provided concerning differences in sex determination, age of sex chromosomes and the effects of sex chromosome drivers on the evolution of these processes.

Burt and Trivers, in Chapter 4 tackle the complex topic of "Genomic Imprinting", the label for the observation that the expression of a gene (or chromosomal region) can vary depending on whether the gene is maternally or paternally inherited. They concentrate primarily on cases from mammals where differential gene expression translates into alterations in parental investment.

In Chapter 5, "Selfish Mitochondrial DNA" the role of natural selection in shaping the conflict between mitochondria and between mitochondria and the nuclear genome are discussed. Uniparental inheritance is presented as a means by which the genome has responded to selection between mitochondria. Burt and Trivers then discuss the appearance of mitochondrial-based phenotypes that benefit only the gender from which the mitochondria are inherited and originate as a by-product of unisexual inheritance.

The processes of "Gene Conversion and Homing" are presented as mechanisms of drive in Chapter 6. To this end Burt and Trivers discuss three phenomena that presumably originated by taking advantage of the host's need to repair DNA damage; 1) biased gene conversion 2) homing endonucleases and 3) group II introns. Biased gene conversion occurs when one allele is preferentially used as a template to replace another. Homing endonucleases and group II introns are genetic units that copy themselves into a single locus (empty site) within the genome. This chapter closes with a discussion of the molecular tools that have been developed based on these drivers, which is interesting if not a bit out of the scope of the book.

In Chapter 7, "Transposable Elements", are discussed in great detail. This group of elements, like homing endonucleases and group II introns can copy themselves, but rather than inserting into a single locus, they target multiple locations within a single genome and propagate to sometimes enormous copy numbers. The mechanisms by which transposable elements move are described, as is the genome's response to their movement.

The topic of "Female Drive" is discussed in Chapter 8. Female meiosis is sometimes referred to as asymmetric because only 1 of 4 haploid cells typically survives to become an ovule, while the other 3 become polar bodies. This peculiarity allows for genetic regions-often, entire chromosomes to evolve means (drive) by which they are preferentially passed to the ovule rather than the polar bodies.

In Chapter 9, the topic of "B Chromosomes" is explored. These are chromosomes that do not provide any fitness advantage to the host, are not necessarily part of the host genome and are able to replicate themselves. Drive of B chromosomes occurs either by gonotaxis or overreplication, although no molecular mechanisms are known.

"Genomic Exclusion" is the topic presented in Chapter 10. Three types of genetic systems where individuals only transmit the set of chromosomes inherited from their mother or father to their offspring are described 1) paternal genome loss, 2) hemiclonal reproduction and 3) maternal genome loss.

In Chapter 11, "Selfish Cell Lineages" it is pointed out that multicellular organisms sometimes display mosaic genetic cell types and this provides the opportunity for selfish cell lineages to arise. The presence of different cell types is in part due to the accumulation of point mutations, mitotic recombination and the accumulation of transposable elements, but also is the result of a mosaic of cell types present in the embryo. The most striking examples of selfish cell lineages are perhaps those that give rise to the various cancers that currently plague us.

In the final Chapter 12, "Summary and Future Directions" Burt and Trivers summarize the topics explored in great detail in the book including the major classes of selfish genetic elements and the host features that may have evolved as a result of selfish genetic activity, highlighting the salient open questions in the field.

This book is an incredible resource for any scientist interested in evolutionary genetics. Burt and Trivers have tackled a huge breadth of topics without sacrificing depth. They are able to compare sometimes seemingly disparate phenomena suggesting numerous connections that are either worthy of further exploration or at least provide the fodder for further debate. This book serves as the perfect primer for those interested in exploring the dark side of the genome and understanding some of the perhaps-underappreciated forces that may have acted to shape it.

Ellen J. Pritham
Department of Biology
The University of Texas at Arlington
Arlington, Texas
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