Book Reviews

Raising the Dead: The Skeleton Crew of King Henry VIII's Great Ship, the Mary Rose. By A. J. STIRLAND. (Pp. xviii + 183; illustrated; £55 hardback; ISBN 0 471 98485.) Chichester: John Wiley. 2001.

On a warm summer evening, 19 July 1545, the *Mary Rose*, the flagship of Henry VIII's Vice Admiral, Sir George Carew, sank off Spithead with the loss of nearly all hands. Over 400 years later, 11 October 1982, her remains again saw the light of day. This book tells the story of the men who sailed and died in her. Chapter 1 gives a brief outline of the circumstances at the time of the sinking of the ship and her subsequent raising. The book is then divided into 2 parts, the first devoted to the historical background and the second an account of the skeletal material that was recovered from the wreck.

Chapter 2 covers the general background of the Tudor navy, together with the history of the construction of the *Mary Rose* and her subsequent refurbishment including armaments. The latter was thought to be relevant to the cause of her sinking, which is still a matter for debate. Chapter 3 is a very brief outline of the social fabric of the England of the early 16th century as a background for understanding the type of men who formed the crew. This is followed by an account of the administration, or rather lack of administration, of the navy of the time and the victualling and pay of the mariners. Chapter 5, the last historical chapter, gives more detail of the officers and men who formed the crew of the ship. Interestingly, in spite of much historical research, the author has been unable to find the names of any of the men who sailed in the *Mary Rose* except for the Vice Admiral, Sir George Carew and the captain, Roger Grenville. From examination of the artifacts recovered from the wreck it is very likely that there was a surgeon and a carpenter on board and it is known from documentary evidence that the men consisted of mariners, soldiers and gunners. A study of the skeletal remains is thus the only evidence concerning these men and, as such, is of unique importance in the historical and archaeological record.

It is thought that about 43% of the total crew were represented which appears to correlate well with the fact that about half of the ship was preserved. The damage to the ship's fabric and the fact that she settled at 60 degrees from the vertical, together with the effects of the tides and silting, meant that there was a vast amount of mixing of material. This presented a nightmare scenario for the skeletal biologist whose first task was to try and sort the scattered remains into individual skeletons. However, the actual state of preservation of the bones was excellent due to the anaerobic conditions of the burial. Chapter 6 details the basic data including sexing, ageing, determination of stature, the calculation of various cranial indices and an examination of the teeth. Compared to a modern day population, the occlusion of their teeth was better but the pattern of caries was similar, which was an unexpected finding and difficult to explain. Chapter 7 gives an account of the general pathology including evidence of infectious disease, fractures and other injuries. When compared with a contemporaneous cemetery in Norwich, the *Mary Rose* men were thought to have little pathology apart from that related to childhood illness and deprivation and also some injuries which may have been sustained during life aboard ship.

Chapter 8 examines possible evidence for occupation and activity. This centres on two occupations: that of archery and the work of the gun crews. There was a high incidence of *os acromiale* (the unfused acromial epiphysis of the scapula) and other unusually strong muscular and tendinous markings on related parts of the skeleton. This led the author to compare in some detail the documentary evidence of accounts of use of the longbow during Henry VIII's reign with a study of the bow as used by a modern-day archer. The fascinating conclusion was reached that the skeletons provided evidence of a group of young men who were physically able to use heavy war bows, The other striking evidence of activity came from the observation that the spines of certain of these apparently young men had a much greater incidence of degenerative disease than would be expected in their age group. It included fusion of vertebrae, ossification of ligaments and the presence of Schmorl's nodes. Their bones, amongst the group of 'fairly complete skeletons', contained crystals of haematite and vivianite and were found together with large guns on the main deck. It is likely that these particular individuals could be the remains of a gun crew.

The last chapter of the book examines how the historical and documentary evidence compares with the archaeological evidence and, although this still leaves many unanswered questions, some interesting observations are made. It is not entirely clear what caused the *Mary Rose* to keel over and sink on that July day as there is no archaeological evidence to confirm the French claim to have sunk her. Contrary to popular belief, documentary sources imply that the crew came from a variety of nationalities including those from countries bordering the Mediterranean Sea. Recent research involving the analysis of oxygen isotopes from the men's teeth has confirmed that some of them spent their childhood in southern Europe. It emphasises the importance of the preservation of unique skeletal collections for further study as new research methods are developed. The remains of food from the ship are still being analysed and will doubtless reveal more about shipboard diet in that historical time and place. The skeletal work undertaken by the author and her colleagues is carefully done and the difficulties inherent in this type of analysis are well explained. Particular care was necessary when attempting to decide what sort of activities individuals were engaged in during their lifetimes from a study of the skeletal evidence alone. The conclusions on the archers and gun crew are especially intriguing.

It seems a trifle carping to complain about the references. They are numbered and refer to notes at the end of each chapter. However most of them refer to a name and date only which then have to be looked up in a list at the end of the book thus entailing a 2-stage process. Also I find that occasionally the terminology, such as 'femurs' instead of 'femora', grates on my anatomical sensibilities. These minor details apart, there is much of interest in the account of the men who perished in the *Mary Rose*.

LOUISE SCHEUER

Developmental Juvenile Osteology. By LOUISE SCHEUER and SUE BLACK. (Pp. x + 587; fully illustrated; $159 hardback; ISBN 0 12 624000 0.) San Diego: Academic Press. 2000.

Traditional gross anatomy has today become very much overshadowed by developments in molecular biology and genetics. Many traditional departments of anatomy within the United Kingdom have lost most of their traditional anatomists, to be replaced by experts in molecular and cell biology. Even the place of anatomy within many medical curricula is open to question and thus undergoing radical change.

Traditionally, gross anatomical teaching and learning has placed most emphasis on adult structures and tended to ignore growth and development beyond the early embryological and fetal periods. This is a sad omission, given the current interest in the fetal origins of adult diseases and the vitally important contribution that development and growth has on the understanding of many clinical problems affecting children, as well as the implication it has for adults.

Part of the reason for this has been the real lack of suitable supporting text which offers any insight into the importance of growth and maturation from the anatomical and morphological view. While there is an increasing knowledge-base related to physiological and functional aspects of growth and development, there are limited resources offering accounts of the morphology for both student and teacher. Similarly, clinically, there is also a lack of easy accessible source data, which often leads to the ongoing need to devise new standards for normality on which to base clinical disease/condition-related findings. What is readily available tends to be limited to growth charts, mainly of normal height and weight, and atlases of skeletal maturity based on the hand or knee. To obtain information beyond these fields often results in a considerable time spent searching for references in journals and other sources.

It was with considerable anticipation of finding the answer to these shortcomings that this new textbook, *Developmental Juvenile Osteology*, was received. And the text has indeed rightly provided a magnificent answer. It rapidly becomes clear to the reader that this work must represent countless hours of detailed reference-checking and follow-up, as well as requiring a wide understanding of the subject. Louise Scheuer and Sue Black have excelled in providing the reader with exhaustive reviews of the growing skeleton, relating its components to the adult structures. However, the greatest bonus in this new book must be its offering of an extensive bibliography to support the text. Over 80 pages of detailed references allow the reader to pinpoint a source for further study, some of which are over 200 years old, others of which must have been added at the last proofreading stage! The newly commissioned illustrations by Angela Christie are also magnificent and bring out the required points to support understanding in a way that only high-quality and skilful drawings can.

The book opens with a description of the layout of the text and is followed by an overview of the developmental process and maturation, with many notes on source material and the application to fieldwork. These prove to be an invaluable scene-setting commentary on the background to the uses of growing skeletal information, particularly if the reader's interests may lie elsewhere. They also serve to put into context the value of skeletal material in developing our understanding of the past in archaeology. The book then covers each region of the body, starting with the skull and then down the axial skeleton and into the limbs. Particularly useful in the head and neck section is the description of dental aging, backed by citation for work from sources such as Demirjiran in Canada and recent work from China and India. Helpfully, the authors have seen fit to include tables on these and other studies which serve to offer instant answers to questions which could arise in the field or laboratory

Other chapters which repay close study (and this is not a book to read from cover to cover!) include those on the vertebral column and lower limb where invaluable source references are cited. This reviewer's particular interest in tibial torsions led him to note many useful comments, although perhaps a lack of information about the application of ultrasound to its measurement in the living. If there were a niggle, it is where the move from osteological to living sources is often not made, but then one recognises that the book is indeed about bone and not anthropometry.

It may also be a reflection on where modern scholarship is moving, but it could not escape the notice of the reviewer that some of the references are from over 50 years ago and that there is, in many instances, a paucity of recent reports. Is this an indication of the movement away from the areas of gross study to the molecular level?

Particular reference should be made to the text's value in bringing together vitally important source data on bone growth, with its tables of length, which often cite diaphyseal as well as total length. Clinically, these tables must be very useful as they can provide normal values for anthropometric measurements collected from the living where such normals are unavailable. However, the greatest value of such information must again rest in fieldwork and age-estimation. Similarly, the detail about the spine and pelvic girdle is informative and valuable in detailing information not easily accessible without considerable searching in journals.

While an exhaustive reading of the text, particular in areas of one's own interest, might pinpoint the occasional omission of citation, it is the sheer scholarship that rewards the explorer of this book. It is without doubt a worthy addition to the field of anatomy and should be a strong 'must have' for anyone interested in the growing human, whether from a clinical, forensic or archeological point of view. It should also find an indispensable place on the shelves of the libraries of all institutions where teaching and understanding of human anatomy is an important component of any courses and their specification or curricula.

PETER DANGERFIELD

The Human Nervous System: An Introduction. By MARION HALL, GISELA OLIAS and DAVID ROBINSON. (CD-Rom; DM 78.88; £29.48; $34; ISBN 3 540 14877.) Berlin: Springer. 2000.

As may be imagined from this Open University production, the information is well designed and easily accessible. This CD-Rom follows on from the successful *The Human Brain*. Each topic starts from the basic contents screen showing seven small screens—How to use, Overview, Nerve cell, Motor systems, Motor system diseases, Touch and pain, and Smell and taste. From this each topic can be followed to give three successive levels of information. On the right is a column of 'buttons' to provide a contents list, index, objectives, texts, new updating giving guidance to recent research and interesting relevant literature, a 'back' button allowing a further look at previous material, a review feature to test your comprehension, and tools—calculator, notebook, camera, photo album, and measure. A final 'help' button is at the bottom of the column.

Travelling through levels is easy. As each topic or picture is displayed, a text can be brought up explaining the picture with hypertext links for further information. At the end of the introductory section the text box has a 'button' for transfer to a second and then a third level of information.

The tests are sensible interactive multiple-choice questions and answers. There are motion-picture and sound sequences to add interest, and the screen display on a standard personal computer was satisfactory. As an elderly, dyed-in-the-wool book-lover, I think that I could acquire the knowledge with greater facility from a printed page while taking notes. However, a member of the younger generation, wishing to gain an introduction to the nervous system, would undoubtedly be able to move nimbly around the material as easily as I can flick the pages of a book. By assessing the acquired knowledge with the multiple choice questions, the young computer enthusiast would probably also outperform me when quizzed about the nervous system.

R. M. KIRK

Development, Growth and Evolution. Implications for the study of the Hominid Skeleton. Edited by Paul O'Higgins and Martin Cohn. (Pp. xiv + 271; illustrated; hardback; ISBN 012 524965 9.) San Diego and London: Academic Press for the Linnean Society of London. 2000.

While others have struggled, comically and memorably, for the 'Meaning of Life', paleoanthropologists must content themselves with a more mundane search, for the 'meaning of morphology'. For all but the last 100000–200000 years of the ~5–8 million years of our independent human evolutionary history, we depend on observations and interpretations of hard tissue morphology to reconstruct evolution. A sound phylogeny is a prerequisite for attempts to reconstruct the evolutionary history of any living group, but it is presently proving more difficult than many of us anticipated to generate a reliable human phylogeny. Just as linkage disequilibrium violates the assumption of the independence of alleles, character correlation (for reasons other than shared evolutionary history) violates one of the important assumptions of phylogenetic, otherwise known as cladistic, analysis. Many have reasoned that if character selection was informed by the influences of development and function, then the adult phenotype would prove to be a more reliable source of evidence for reconstructing phylogeny. This book records the result of a pioneering, at least in palaeoanthropology, attempt to bring together developmental biologists, auxologists, morphometricians and palaeoanthropologists to determine where these disciplines can most productively combine to improve the analysis of the skeletal and dental remains that make up the fossil record of human evolution. The analytical focus of this book is on phylogeny rather than function.

Three excellent papers set the developmental 'scene' for the skull (Schilling and Thorogood), the dentition (Ferguson, Hardcastle and Sharpe) and the limbs (Cohn and Bright). All stress 'the striking conservation of the genetic control of pattern formation' and all 3 should be required reading for palaeoanthropology graduate students. Skerry's contribution tackles the important interface between function and development, and properly points to his group's important contribution to our understanding of the link between skeletal loading and gene expression. Two papers deal with the capture, representation and analysis of information about skeletal growth. Spoor, Jeffrey and Zonneveld set out the opportunities provided by traditional and newer imaging methods, such as CT and MRI. In a commendably clear exposition, they show how these imaging techniques can be combined with modern morphometric methods to, respectively, capture and analyse data about cranial growth. O'Higgins makes a persuasive case for using matrices generated from 3-dimensional coordinates (Euclidean distances), as in Euclidean Distance Matrix Analysis (or EDMA), as an alternative to traditional interlandmark distance data. He focuses on the growth of the face and the worked example he provides is a fine primer for anyone wishing to use geometric methods to investigate ontogenetic and phylogenetic trajectories.

Schwartz and Dean focus on the dentition. Dental hard tissues do not remodel during ontogeny, thus teeth provide an excellent system for those attempting to investigate the developmental basis of morphology. In a useful and comprehensive survey, to which is appended a very useful glossary, Schwartz and Dean review many of the ways dental microstructure can contribute to the study of human ontogeny, phylogeny and life history. Dental ontogeny can be reconstructed at the cellular level, and Ferguson et al. show in their contribution how close we are to understanding the signalling interactions, particularly those involving the *Bmp-4* and *Shh* molecules, that initiate and sustain tooth development. However, as far as the reconstruction of human evolution is concerned, species recognition and phylogeny reconstruction focuses on details of cusp and root morphology. Thus, it is a particular frustration to read that one of the significant gaps in our current understanding of the patterning of the dentition is how cuspal morphogenesis is controlled; specifically we remain ignorant about the 'molecular and cellular mechanisms that direct the temporal and spatial folding of the internal enamel epithelium to generate cusps' (pp. 199). We look forward to the day when developmental biologists close the gap between Ferguson et al.'s signaling molecules and Schwartz and Dean's daily cross-striations, and identify the molecular signals that determine root morphology.

The 3 remaining papers make explicit attempts to explore the links between development and phylogeny reconstruction. Lieberman shows that 'browridges' are an epiphenomenon borne out of the need for the face to maintain its attachment to the neurocranium. He suggests that browridges are a consequence of particular combinations of facial projection and cranial base flexion. Thus if, despite detailed differences in phenotype, they are compared using crude nonmetrical categories, or simple measures like browridge length, 2 browridges might be judged to be the same character state despite clear differences in the way they are generated during ontogeny. Oxnard's multivariate morphometric analyses of regional functional complexes are well known to primatologists interested in numerical analysis. In this review he shows that when these regional data sets are combined in 'total evidence' analyses, the clustering conforms (at least at high taxonomic levels) more closely with clades than with functional grades.

The third contribution is the only interdisciplinary attempt to meld molecular development, function and evolutionary history in the context of higher primate evolution. Cohn, a molecular developmental biologist, has combined with Lovejoy, a long-standing and respected student of the postcranial skeleton, and White, a well-known palaeoanthroplogist, to suggest how this should be done for the limbs, but presumably the principles (their trait typology) would be applicable elsewhere in the skeleton. Their contribution concentrates on tissue differentiation, spatial organisation and growth and modelling, and develops themes introduced in an earlier paper (Lovejoy et

al. Proc Nat Acad Sci USA **96**, 13247–13252, 1999). They concentrate on 2 examples, reduction of the great toe and the relative size of the components of the lumbar spine, and argue that the phylogenetic and functional significance of these morphologies cannot be properly assessed without considering their molecular developmental histories. Phylogenetic analysis has always drawn on development to help interpret the polarity of characters, and practitioners will doubtless need to keep a weather eye on advances made in molecular developmental biology to make sure that traditional character classifications are updated to incorporate new insights about the molecular mechanisms of development. However, the difficulty with Lovejoy et al.'s approach is that their "guidelines for the interpretation of fossils" are based on a system of trait typology which is, in turn, predicted on a set of complex, and largely untested, hypotheses. They could be tested, but on systems a good deal more experimentally tractable than the higher primate skeleton. For example, a recent study (Kopp et al. Nature 408, 553–559, 2000) provides an elegant demonstration of how genetic analysis can be used to tease out the interactions of the pathways of gene expression that converge on the development of what, at least from a higher primate perspective, is a relatively simple phenetic system, namely the pigmentation of the abdomen of the fruitfly. Also because of the remarkable conservation of developmental mechanisms, we must be wary of using the latter to make inferences about relationships. Homoplasy is at least as rampant, if not more rampant, in ontogeny as it is in phylogeny. There is a good deal of work to be done before molecular mechanisms can be used effectively to improve methods of higher primate phylogeny reconstruction, but we must be grateful to Lovejoy et al. and others before them, for having at least started the ball rolling.

This book is an important step in the process of improving the efficacy of methods for the reconstruction of higher primate evolution. The authors are to be congratulated on their efforts. It also underscores the need to bridge the gap between our knowledge of the molecular basis of pattern determination, and the molecular mechanisms that determine the detailed phenotypic differences between species. The agenda is a full and challenging one, and we share the regret of all the contributors that these research problems will have to be addressed without Peter Thorogood's intellect and unique interdisciplinary perspective.

BERNARD WOOD