

of analysis toward which the present volume is directed. It is divided into five main sections, following a brief topical summary by the editor. The first section, on "Altruistic Behavior and Social Organization," begins with a paper on problems of social insect evolution, and then reprints a mathematical model by W. D. Hamilton attempting to account for behaviors of individuals which may benefit the survival of a whole group, as opposed to individual survival benefit in the theory of "classical selection." Part II then selects papers dealing with "Adaptive Regulation of Population Density." It is devoted principally to the position of V. C. Wynne-Edwards on the question of "how groups can override the concurrent selection for individual advantage," implying the belief that groups do effect such "overrides." In another paper in the volume, J. Maynard Smith controverts this since "it is difficult to see how kin selection could bring about the evolution of the many types of population regulating behavior which Wynne-Edwards believes he has discovered."

Part III, consisting of a single short paper by M. J. Dunbar, provided some argument that evolution can indeed effect regulation of numbers by, for example, lengthening the reproductive and growth cycles of colder regions where energy sources are relatively less than in the tropics. This paper gives way to part IV, on "Sex Ratio" containing three papers on the origin and theoretical mechanisms for the maintenance of sex ratio, which in turn lead to four papers on "Sex" in part IV. Here the only paper which is new for the volume appears, by J. Maynard Smith on "The Origin and Maintenance of Sex." He argues that sex maintenance is due to the added advantage it provides through faster recombination as environments change, as opposed to the slower mechanism of accumulation of new effects proposed by Muller, but modeled by Kimura and Crow, whose paper also appears in the volume.

Finally, we are given an annotated bibliography of three pages and fifteen entries. The introduction to the bibliography contains a clue to the main weakness of the book: "some of the articles listed below would have been suitable for reproduction in this book, but for one

reason or another they were omitted." This is undoubtedly true, but only compounds the feeling that the text was not quite long enough due to omission of principal papers, leading in turn to a weak organization (does the single paper of twelve pages of part III really deserve a separate section?). This feeling that something has been omitted results as well from the complete absence of any bibliography in the book, other than the fifteen annotations, making it necessary to refer back to the original papers whether one desires a detailed reference, or intends to do more work on the problem. This tendency for some reprint publishers and editors to purge papers of their original references is one good reason why serious professionals might prefer to purchase the original papers at five cents per page in their local library copy service.

It thus appears to the reviewer that the book has several uses to anthropologists. First, those who enjoy models of the type found at the beginning of this review or are interested in the problems raised by the model, will find more of the same, together with a short but correctly annotated bibliography leading to other material. Second, those teaching or taking a course in human or theoretical biology will find the material covered relevant and thought provoking due to the organization of the book as a controversy over main issues. Group Selection is not suitable as a principal text for courses primarily directed to human problems, but may be useful at \$2.95 paperbound as a supplementary reader which will lead one immediately into the library.

PAUL A. BALLONOFF  
*University of Illinois,  
Urbana*

GROWTH AND DEVELOPMENT IN NEW GUINEA—A STUDY OF THE BUNDI PEOPLE OF THE MADANG DISTRICT. By L. A. Malcolm. 105 pp., figures, tables, appendices, bibliography. Monograph Series No. 1, Institute of Human Biology of Papua and New Guinea, Madang. 1970. \$A2.00 (cloth).

This is a new study of Human Biology, primarily of the Bundi people of the Madang District of New Guinea, living at relatively low altitudes (600–2,000 meters)

and involving 1741 children and 1228 adults, most of them studied in a one-month period in 1967. It was originally submitted as a thesis for the degree of Doctor of Medicine, and was apparently sent to press in 1970.

It is fascinating, as it includes such exceptional growth phenomena as menarche at age 18+, adult statures of 148 cm (Bundi women), and dietary fat intakes that must be down below 2 gm/day. In the Catholic Boarding School the stated diet is taro (800 gm) and sweet potato (300 gm) surely not 3009 as printed, and no titbits of frogs, spiders and insects as back home, in the villages.

In this part of New Guinea, infant mortality is extremely high, but dropping, family planning stretches the interval between births to a tidy four years, and by the time of total family completion the 50 year old mother has a reported 5.9 pregnancies, and a reported 4.7 living children. It is an area where malaria accounts for 21 percent of recent-hospital admissions, 7 percent of infants are so parasitized, and hook-worm is almost universal. From these stated facts, it is to me unlikely that "It is therefore unlikely that disease is a significant factor in the slow growth rates in Bundi" (p. 80).

And slow linear bodily growth is, 5 cm below British infants at 3 months, 34 cm behind at 14 years, and close to 20 cm behind near adulthood. Against this size record, one may note weight — not even 10 kg at 2 years, 21 kg at 10 years, and 51 kg in young adult females dropping to 46 kg in older women. They grow slow, the Bundi do, but weight for height in young adulthood presumably represents an adaptation to what they have to eat and what they do.

Malcolm provides tables galore (67 of them) for height, weight, fatfolds, etc., and graphs, for sizes and increments and fatfolds and weight for height, all in comparison with British (Tanner) norms. There are detailed tables on teeth (but without information on caries), limited serological data, hemoglobin data and serum proteins, and parent-child correlations.

For the voluminous data we give multiple thanks, though asking how the eruption means were calculated — by way of

example — with or without smoothings for the one year class-intervals. For the comparisons, somewhat less gratitude is merited, since it is not stated whether Bundi are ahead or behind Europeans in either deciduous tooth or permanent tooth eruption (though the means are there) and such other measures as skeletal development are perfunctorily dealt with. Skeletal age (determined by R. H. Whitehouse) is far, far below British standards, through age 18 and 19, and is probably four years behind Greulich and Pyle in the later teens, I would judge. Which centers are behind the most, and in what order, and how the Bundi hand compares in dimensions and proportions are not considered at all.

Realistically, there is much useful information and much data reduction and partial analysis. Realistically, one wonders about the extraordinarily low reported fat intakes on the school diet (under 2 gm a day) but presumably the very high vitamin A content of sweet potato is found in the 0.3 gm fat per hundred gram table portion. Comparing the taro and sweet potato intakes, I would adjudge the total protein intake to be not far from 0.5 gm per kilogram, which is realistic for growth and development though one-half of the Recommended Dietary Allowances, and I am not so sure that the combination of tuber proteins is biologically poor. And, even if taro leaves and stems are not consumed in the school dietary, the vitamin C intake would be satisfactorily above 60 mg per day.

In the discussion, often perfunctory, Dr. Malcolm touches on a wide variety of developmental problems — say Growth Stimulating Hormone — but with few references, and with little reference to the extremely large current literature on protein requirements, the interactions between malnutrition and disease, and on protein-calorie malnutrition in general. He reiterates an observation, cites a single reference, and that is that, thesis and monograph style.

I do not mean to carp. Here is a wealth of hard-won field data and record-searching, and enough material for several lectures in any standard course. There are questions to ask, however. If the Bundi infant and child truly gets food for the

asking, and it is never far from the mouth, why isn't the caloric intake larger? When the pigs are killed, how much pig does he get, and for how long? Why is Malcolm sure that disease is not a factor in the slow Bundi growth, and what do the dead infants die of? Is menarche actually delayed until after epiphyseal union? And at such reportedly low levels of fat intake, what malabsorption syndromes exist, and what of the fat-soluble vitamins, and what are the sources of vitamins D and E? What is the dietary source of Bundi sodium, what are the limiting amino acids, and what is in the "greens" mentioned but not discussed? As final query, once educated, what do the Bundi now do, and do they make their boarding-school diets the new norm eschewing the chickens and cows and peanuts they are beginning to have and rear?

Malcolm suggests, not unreasonably, that there has been nutritional selection for small body size among the Bundi. Suppose they were given 2200 calories not 1400 as school children, 60 grams of quality protein, not a meager 12, not as a short-term test but over a prolonged period. Would it take 200 years to begin to approximate us, would they match us, would they grow like the post-war Japanese, are they genetically small or remarkably under-fed, and would they then show that 100 years of anthropometry has measured nutritional status and not population genetics? There is far more for us to answer in the Malcolm monograph, and so much for him to demand of us.

STANLEY M. GARN  
*University of Michigan*

ATLAS OF FOSSIL MAN. By C. Loring Brace, Harry Nelson, and Noel Korn. x + 150 pp., figures, bibliography, index. Holt, Rinehart and Winston, New York. 1971. \$3.25 (paper).

Teaching and learning aids for physical anthropology are on the increase at last, especially those presenting human fossil materials. But, since not every kid on the block can afford his own ersatz Sterkfontein mandible (nor can the best casts be financed by many a dwindling school budget), a genuine need exists for

inexpensive supplements. In my opinion that need is well met by Atlas of Fossil Man; the present review is offered by a college teacher rather than by a student of human paleontology.

The core of the Atlas consists of a series of large scale drawings, usually one per page, showing essential views of fossil or comparative materials. To organize their use, Preface, Acknowledgments, Contents, Introduction, General References, and Index sections are available—all clear and serving their intended function adequately. A short section outlining four major "Phylogenetic Trees" is also quite easy to read and understand, though not leafed out with much detail.

Since drawings constitute the main attraction, their mode of presentation must be closely examined here. They are said to serve students at any level who ". . . wish to have a visual picture of the more important pieces of the evidence for human evolution." Consequently readers are spared approximately 94,000 words at 1000 words per picture; indeed, one of the positive features of the Atlas is an absence of verbiage. With the drawings go just enough information to point up key bibliographic, cultural, temporal and anatomical characteristics. This serves the student through reduction to essentials, and the teacher as a corpus of manageable facts. I'm sure the choice of what to say was an editorial struggle for the authors, and only occasionally did the trivial displace the critical.

An advantage, to learners, of drawings over photos lies in their capacity to capture essential features while ignoring the rest; photos and casts were redrawn by camera lucida, apparently for that reason, but also to avoid unconscious bias. The result is a series of strongly realistic penned images of quite consistent style (for which the two artists are to be commended). Since each illustration fairly fills its page, scales do differ; most American students don't think in centimeters, and the accompanying centimeter scales add little. Further editions might be enhanced by direct conversions, independent of metrics (such as "1.2 times actual size"), even if metric accuracy is neither claimed by the authors nor really required.