"selfish gene" reductionism without apparently grasping the rationale for that suspicion. The undisputed fact that social groups have complex interactive properties which may be mistaken by researchers focussing attention on individuals is thoroughly confused with the question of the roles of group versus individual selection in the evolution of adaptation. I am not cavilling on this subject, for the author's imagined critique of individual selection is a major, recurring theme of the book. He begins Chapter 4 with this paragraph (page 45):

I hope I have by now established that both the selfish-gene approach from below and the group selection approach from above are needed for an adequate explanation of social behavior, no matter the species. When we get to primates, the need for a dual causality model rather than a one-way model is emphasized since primates can act with clear selfishness or in concert, as the situation demands.

By this point, sociobiologically sophisticated readers may have decided to take a walk, and that is a pity, for the book's strengths lie just ahead.

One strong feature is Freedman's cross-cultural review of sex differences in the behaviour of human children. Cultural anthropologists have seldom standardized methodology or collected quantitative data, so the psychologist's touch is valuable here. Among the many interesting phenomena described are the prevalence of acknowledged hierarchies of "toughness" among small boys and the irrelevance of the same dimension for girls. Also intriguing are data on children's drawings, in which thematic sex differences are highly consistent across cultures even as substantial between-cultures variation is manifest.

Fifty student research projects carried out under Freedman's aegis (and outlined in a fifty-page appendix) are discussed in the text. Though highly variable in quality, these studies introduce a number of innovative methods and provocative findings. For example, modified TAT cards (pictures about which subjects are invited to tell a story) are used to assess the emotional impact and status significance of facial hair and of relative height, with results that sometimes contradict the respondents' professed attitudes. In a similar vein, the dimension of kinship is added to another standardized psychological instrument, Kohlberg's Moral Dilemmas, in order to provide evidence that people apply different moral codes to kin and non-kin. The use of such techniques should inspire readers interested in developing a sociobiological psychology.

The concluding chapter, entitled "Biology or culture?" begins with a not altogether successful attempt to dismiss such unproductive either-or-ism: "There is no way to separate the genetic and the learned for they are permanently glued together, and that is true everywhere in nature, including man". Heaven knows what is meant by "learning" if it is

manifest "everywhere in nature", but most readers will probably find the sentiment acceptable if not the logic offered in support of it. Freedman then reviews his own convincing evidence for population differences in human infantile behaviour and temperament, proceeds to speculate plausibly that such differences may be causal to non-arbitrary cultural differences, and somehow concludes that racial "antagonisms are more or less built into the species" and that "the only sound solution lies in miscegenation". One is left perplexedly leafing back, vainly trying to reconstruct the extraordinary logic of this argument.

Robert Wallace's *The Genesis Factor* is blurbbed as "the first popularly written book on sociobiology". If popular writing consists in talking down to one's readers and in disdaining to cite sources, the characterization is correct. Popular writing also apparently entails a suspension of respect for fact. Here are just three examples: parental care occurs in "only a few isolated species" of fishes (page 37); gorillas are "highly promiscuous" (page 76); and the administration of androgens to infant female mice transforms them into killers

without interfering with normal oestrus (page 116). Even where a particular experiment is under discussion, Wallace is liable to serious mis-statement of the results, as in his treatment of Harry Power's mountain bluebird removal experiments (page 179). Running roughshod over such disparate subjects as IQ and the alleged adaptive value of death, Wallace's book will regrettably reinforce antibiological prejudices of some social scientists while proving an embarrassment to thoughtful biologists. It ends on an even more remarkable note than Freedman's book, namely the author's personal foreign policy recommendations for the United States government! With friends like Wallace, sociobiology has no need of enemies.

Let us hope that we will see more and better empirical work of the sort initiated by Freedman. And may we have fewer grand statements of the policy implications of human sociobiology, at least until the discipline grows up a little. □

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Orcadian heritage

Euan W. MacKie

Investigations in Orkney. By Colin Renfrew. Pp.234. (Society of Antiquaries: London. Distributed by Thames and Hudson: London, 1979.) £20.

UNTIL the recent oil discoveries the Orkney Islands seemed remote from and peripheral to modern Britain, yet several times in the past they have been at the crossroads of important movements of people and influences. These usually came either up the western seaways from Atlantic Europe, like the stone tomb-builders of Neolithic times and elements among the inventors of the Iron Age tower-forts known as brochs, or, like the Norsemen and the Early Bronze Age Beaker people respectively, westwards from Scandinavia or north-westwards from the Low Countries or the eastern mainland of Britain. Like the churning cross-currents of the Pentland Firth, these genetic and cultural mixtures often produced periods of striking local developments in the islands. The sandstone of which these are formed provided ideal building material and some remarkable developments in drystone architecture resulted.

Archaeological research in Orkney has been sporadic in the past with long periods of inactivity, but the early 1970s saw a burst of new work by visiting excavators. Sites

like the Neolithic dwellings at Skara Brae and Knap of Howar, the Pictish and Norse village at Buckquoy, the prehistoric and early historic settlement at Skail and the Neolithic chambered tomb at Quanterness (the main subject of the book) were explored with modern techniques for the first time. Knowledge is still advancing rapidly through the efforts of a new resident team of archaeologists financed by the Scottish Development Department, the North of Scotland Archaeological Services Unit based at Finstown.

Professor Renfrew has long been concerned to explain in modern terms the dramatic changes visible in the prehistoric archaeological record, such as the appearance of the chambered burial mounds of Atlantic Europe at around 4200 BC, and he favours hypotheses of indigenous development rather than any involving the diffusion in some way of ideas and skills from more advanced cultures. The radiocarbon dates for the earliest European chambered mounds have in any case shown them to be older than those of the Early Bronze Age in the Mediterranean world which were originally suggested as prototypes. Another aspect of this new approach is the interpretation of the tombs in terms of the kind of societies which built them and of the environment in which these people existed. The cairn at Quanterness is the first in Orkney to have been investigated with these general problems in mind.

One example of the detailed mass of evidence collected may be cited.

The Knowe of Yarso, Rousay.

Quanterness is an architecturally sophisticated tomb and its period of use was determined by radiocarbon measurements to between about 3200 and 2500 BC. (This itself is important as it shows clearly that the tomb is relatively late in the Neolithic period and in the Orkney series, refuting again the old diffusionist theories which demanded that the most

sophisticated buildings were built first, by the original skilled colonists.) The number of individuals buried collectively — generation after generation over a period of 550 ± 180 years — in this great roofed stone vault was estimated from the thousands of disarticulated human bones recovered to be about 400. Both sexes and most age groups were represented, and the

conclusion drawn is that all the members of a small farming community of 13–20 people were buried in the cairn.

These results, and those of the many other detailed researches carried out, form a landmark in our understanding of Orcadian Neolithic society — a mass of hard evidence which will provide a minimum standard for all future work. My only doubts concern some of the conclusions drawn from the data, particularly the failure to consider in any way — even simply to dismiss it — the alternative social interpretation of these cairns. This, argued in some detail in my book *The Megalith Builders* (reviewed in *Nature* 270, 644; 1977), suggests that the people buried in the cairns could have been the members of a non-farming section of the Neolithic population, most probably of religious orders which were linked genetically and by shared architectural and funerary traditions to the other cairn builders all over Atlantic Europe. The work at Quanterness has not disproved this interpretation unless this is considered to have been achieved by the author firmly looking the other way. □

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Immortalized in a virus

D.H. Watson

The Epstein-Barr Virus. Edited by M.A. Epstein and B.G. Achong. Pp.459. (Springer: Berlin, Heidelberg and New York, 1979.) £34.50.

EPSTEIN-BARR (EB) virus was discovered in 1964 by the two workers immortalized in its name; they identified particles with the characteristic morphology of the herpes-virus family in lymphoblasts cultured from a lymphoma of a type first described in African children by Burkitt in 1958. The first chapter in this volume is an account by Epstein and Achong of this early work in which Epstein's inspiration was to examine cells cultured from the tumour after an earlier fruitless search in biopsy cells.

Since 1964 a formidable body of published work has been amassed by workers from a wide variety of disciplines using an impressive array of biochemical and biological techniques. The remaining articles in this volume, written by a number of those who have made notable contributions, summarize and review progress since 1964.

Serological studies played an important initial role, and an early chapter by Ernberg

and Klein is appropriately devoted to an account of EB antigens. This sets the stage for a description by the Henles of their notable serological studies, which not only identified EB virus as distinct from other herpesviruses but most unexpectedly showed that the virus was ubiquitous, often occurring in leukocytes of healthy donors in many parts of the world. This led to the link between the virus and infectious mononucleosis and also with a second rare malignancy, nasopharyngeal carcinoma. Plainly the major stumbling block was the lack of a unique or even consistent relationship of the virus to the malignant conditions.

Molecular hybridization studies, excellently described in articles by Pagano and Shaw and by zur Hausen showed, however, that virtually all nasopharyngeal carcinomas and African (if not American) Burkitt lymphomas contained virus DNA.

There still remained the difficulty of explaining why such a widely distributed virus apparently produced tumours in restricted geographical areas. Burkitt himself suggested that a malarial co-factor might account for the lymphoma but although, as indicated in a later chapter by Epstein, there is supporting evidence for this idea, it would seem that it cannot be a unique co-factor given the comparative rarity of the lymphoma, even in its favoured locale, in doubly infected individuals. Others have argued for strain

variations in the virus and this is discussed in the chapter by Pagano and Shaw as well as by Miller.

A further twist to the tale is provided by the recognition that the virus DNA may sometimes exist in the cell in a non-integrated ('episomal') form and at other times be integrated as described here by Adams. He, like Pagano and Shaw, envisages the rare change to malignant transformation from non-malignant proliferation as being mediated by insertion and operation of transforming sequences.

The other chapters are equally absorbing, dealing with aspects as varied as the recent IARC prospective sero-epidemiological survey (de Thé; see also *Nature* 274, 756; 1978), prospects for vaccine control (Epstein), and comparative studies on oncogenic herpesviruses (Deinhardt) — to make what must in the space available be an arbitrary selection.

The volume will be useful to those from many disciplines in which EB virus has become important, in providing them with a useful statement of the current situation. Even those directly involved in the large numbers of publications on the virus will welcome the presentation in one place of such a wide-ranging survey. □

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