Mistaken identities

James V. Neel

Human Biodiversity: Genes, Race, and History. By Jonathan Marks. *Aldine de Gruyter: 1995. Pp. 321. DM96, $46.95 (hbk); DM46, $23.95 (pbk).*

ANTHROPOLOGISTS and geneticists alike will find this well-researched and well-written book on human variation both instructive and challenging. And anyone interested in the concept of race, how it has been used and abused and how it is viewed today, will find it a fascinating read.

The first half is essentially didactic. The author begins by tracing the evolution of views of humankind, arguing that, just as Darwinian thought dominated the late nineteenth century, so Franz Boas dominated the early twentieth:

> Boas brought cultural theory to its logical culmination in the 20th century. Darwin had undermined the biology of anthropocentrism and made it no longer possible to assert that the human species is "better" than a species of mole, for they are simply divergent offshoots of a common ancestor. So, too, Boas destroyed the underpinnings of ethnocentrism by which Western society saw itself as superior to other lifeways — it was different all right, but value judgments were ultimately based on arbitrary criteria.

Marks provides a brief but useful review of Mendelian inheritance and the mechanisms by which the human gene pool can change, as well as a summary of what we know about human evolution. He then looks at the efforts of physical anthropologists to classify humankind, the most recent low-water mark, in his opinion, being Carleton Coon's now discredited attempt in 1962 to recognize five races, and at the efforts of scientists to disentangle cultural and biological differences between groups of people. And inevitably there is a chapter on eugenics: as always, the recitation of the bigotry and prejudice of established biomedical scientists and the social actions stemming from the movement just 60 or so years ago make sobering reading.

Marks seeks to draw a firm distinction between racial anthropology, an objective study of biological differences among human groups, and racist anthropology, which superimposes value judgements on the observed differences. He examines the ways in which human variation can be studied, ranging from the traditional morphological approaches to the more recent biochemical (blood types, enzyme variants) and, now, molecular (DNA) classifications. He records the shock waves in the community of physical anthropologists when it became clear through the work of Boas, Harry Shapiro, Frederick Hulse and others that the cephalic index, that standby of physical anthropology, was significantly different in immigrant populations than that found in the native population, a shock that sent anthropologists racing to embrace the use of genetic markers.

Barambo *mu* dancers from Poko in the Belgian Congo, from a hand-coloured slide by Herbert Lang (1913). The picture is taken from *American Museum of Natural History: 125 Years of Expedition and Discovery* by Lyle Rexer and Rachel Klein, which chronicles the history of the museum's expeditions around the globe, including those of the polar explorer Robert Peary and the anthropologists Franz Boas and Margaret Mead. Abrams, $49.50.

The second half of the book is devoted to more-or-less self-contained essays on particular topics coming under the umbrella of 'human biodiversity'. Here the author works without fear or favour, studding his essays with trenchant comments. Having considered human diversity in the light of modern genetics, he sums up thus: "Like morphological differences across the human species, these (genetic) groupings are generally obvious when extremes are contrasted, but otherwise there is little in the way of reliable biological history to be inferred by genetics". And writing about the Human Genome Project, the first example of Big Biology, he says:

> By virtue of focusing strictly on pathologies, the Human Genome Project, as originally proposed, falls into precisely the same conceptual framework held by the eugenicists. This is the idea that there is a single normal state for a given phenotype, whose nature is self-evident, and against which any deviation must be judged. This is true only to the narrowest extent, in the study of medical pathology. Where the eugenicists fairly explicitly held all deviation (including social and moral) from a narrowly defined ideal to be genetically pathological, the assumptions of contemporary genome enthusiasts are instead more implicit in simply adopting the paradigm of medical pathology to molecular research.

He also attacks the Human Genome Diversity Project (which came into being partly as a response to such criticism):

> The major goal in this effort, unfortunately, is thus also guided by an archaic idea: the establishment of the ultimate genetic phylogeny of human groups. In pursuit of this objective, advocates are obliged to maintain that non-European human populations are generally "pure," and have been spared the vagaries of history, of contact, and of gene flow — assumptions that are certainly gratuitous.

These are strong words, apparently strongly motivated by the concern that the intermingling of early human populations, like those recorded for historical populations, were so extensive as to preclude the possibility of reconstructing the evolutionary relationship of human populations.

There is, perhaps, in this broadside the danger of throwing the baby out with the bathwater. Dendrograms are also useful graphic representatives of the similarities and differences between populations — however they are arrived at. But it must always be remembered that custom requires a 'best' dendrogram to be presented, and other dendrograms of the relationship of a set of populations, almost

Kwakiutl North American Indian mask of "born-to-be-head-of-the-world" collected by George Hunt, Franz Boas's field assistant, in 1901. From *American Museum of Natural History* (see p.589).

as satisfactory by the 'minimum string' concept, may look quite different. I agree wholeheartedly though with the author's statement that:

> The a priori knowledge that most human genetic variation is polymorphic, rather than polytypic, should make it more important to preserve many samples from relatively fewer groups, than to preserve few samples from many groups, if one wishes to study the general extent and nature of human genetic diversity.

In dealing with the adaptive nature of human variation and the 'health' differences between populations, Marks unsurprisingly concludes that although such human traits as bipedal locomotion, large cranial capacity and pelvic structure are adaptive, the adaptive significance of most within-human variation is obscure, apart from such examples as skin pigmentation and the sickle-cell trait. Furthermore, ethnic differences in disease patterns are not related to genetic variation, again with a few exceptions such as malaria resistance due to the possession of the sickle-cell trait.

Marks also returns to the hoary question of "Human Traits: Heritage or Habitus?", where heritage is defined as inborn (that is, genetic) and habitus as acquired (that is, culturally imposed). Dismissing all comparisons of the behaviour of humans with that of non-primates, he writes:

> When we confine ourselves to our close relatives, however, we find (1) such a difference between human behavior and that of the apes, and (2) such a diversity of behaviors among the apes that it becomes difficult to argue for much of any human behavior being the result of heritage rather than of habitus.

Although granting that "human behavior, like all phenotypes, has a genetic component", Marks then develops the case that "it is difficult, if not impossible, to match genes to behaviors". Geneticists interested in the genetic basis of deviant behaviour will find his discussion stimulating.

Marks ends by reiterating a dominant theme of the book, that scientists dealing with human differences have social responsibilities not shared by those dealing with differences between clams or fruitflies, responsibilities too often abused in the past. Nor is he too happy with the present: "We seek a path of self-awareness through genetics, yet we are constantly led into intellectual cul-de-sacs". The overarching theme of this book is that despite the obvious differences between individuals and groups of individuals, the similarities are now seen as so great, and the gradations between groups so subtle, that attempts at ethnic classification are almost reduced to a trivial pursuit. But as he says in his concluding sentence, "it is tempting to commit those mistakes again and again". This book will be much discussed. Read it. □

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Current revolutions

Andrew Holmes-Siedle

The Quantum Dot: A Journey into the Future of Microelectronics. By Richard Turton. *W. H. Freeman/Oxford University Press: 1995. Pp. 211. £11.99 (pbk), $25 (hbk).*

GIVEN the need for information technology to progress continually, what is the next step when we have exhausted the possibilities of microelectronic devices on silicon? One answer is quantum dots, wells and wires. Although the author has chosen a catchy, futuristic title alluding to these possibilities, he deals with them only in the second half of the book.

Quantum dots are minute microelectronic structures usually made of III–V compounds such as gallium arsenide. The scale of the structure, about 10 nm, is small enough to allow the wave properties of the electron to come into play. Using the growth of films of III–V compounds by molecular-beam epitaxy, linked with submicrometre lithography, such 'droplets' can be produced in tightly packed arrays, and 'quantum wells' can be made inside. The well is like a little box (or conduit), suitable for handling a single electron. These III–V compounds also convert current to light, so optoelectronic methods can be explored. Very small packets of charge can be piped around these structures — smaller packets than are possible for silicon. Here lies one of the possible waves of the future. AT&T is exploring it, so there must be something in it.

This is primarily a book on integrated circuits, however, firmly footed in the silicon age. Intended for the uninitiated reader, it outlines the basic principles of how countless functions are packed into a small 'chip' — mostly using device physics from before the age of quantum wells — and ends with a useful explanatory description of the possible next steps after silicon.

Whenever I explained to my late mother-in-law the design of a silicon chip, she usually responded by asking: "How ever do you think of these things?" Modestly, I would reply by saying that it was not me alone who did the thinking, that I had been trained to and so on. But the question has resonance. Although not the main purpose of the book, one of its merits is that it gives a hint of just how we do think of these things. With unusual thoroughness — one might say patience — the author explains the physical effects used in the design of semiconductor devices in terms of simple concepts, drawing analogies to tennis balls and pieces of string. One could say that he has reduced semiconductor physics to childish concepts. This is not intended as a sneer; while looking at the pictures, it occurred to me that, for some of the best scientists I know, the process of clarifying physical observations consists of reduction to very childish concepts. It is the drive to their thinking; only later comes complexity, when the concepts are subjected to the trappings of conventional disciplines such as those of mathematics or computer software.

At least the author avoids talking about 'silicon chips'. Long gone are the days when device designers, like woodsmen, hacked a piece of semiconductor off a crumbly ingot. Chips are crafted by large expensive machines, and ingots are six feet long. But the mechanics of production is only lightly touched on here. The author concentrates on the physics of the products.

It is a pity that he did not run the manuscript past an electronic engineer: the description of the basic MOS gate logic circuit is completely wrong. But the physics is sound, and, more to the point, can be understood by the lay reader. The book's occasional factual defects should not prevent it from encouraging readers to explore further how we may control and channel electrons and holes in electronic gadgets. Its usefulness need not stop at the lay person; an intuitive scientist will also get a charge out of it. □

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