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ecologically sound regional economies, challenging the economic and political forces that exploit natural and human environments (Sarkar 1992). Here, inspired by spiritual renewal, a personal ethic of non-harmfulness and service, and led by locally-governed cooperatives, there is a balance between individual freedom and social responsibility. Regional economies tied to local watersheds and cultures help prevent over-industrialization by balancing agricultural, industrial, service and retail sectors. Each region collaborates on a national and then global scale to guard rivers and oceans, to protect indigenous culture, and prevent exploitation.

References Cited:

Bullard, Robert D.

1994. "Overcoming Racism in Environmental Decisionmaking," *Environment*, (May 1994): 11-20, 39-44.

Sarkar, Prabhat Rajan.

1987. *Neo-Humanism in a Nutshell*, Part 2, Calcutta, India: Ananda Marga Pracaraka Samgha.

Sarkar, Prabhat Rajan.

1992. *Proutist Economics: Discourses on Economic Liberation*, Calcutta India: Ananda Marga Pracaraka Samgha.

Adaptation to Malaria: The Interaction of Biology and Culture. Edited by Lawrence S. Greene and Maria Enrica Danubio. xiv + 490 pp. New York: Gordon and Breach. 1997.

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Malaria currently affects over 400 million people worldwide. Seeing that this number continues to grow, Greene and Danubio (p. 2) rhetorically ask whether "future health endeavors might profit from an understanding of the way in which human populations have adapted to malaria in the past--both biologically and culturally." This volume highlights their insightful statement.

At the outset, potential readers should be warned that despite the title, this informative, interdisciplinary volume is not a treatise on the broad scope of human adaptation to malaria. Rather, an impressive list of contributors examine glucose-6-phosphate dehydrogenase [G6PD] deficiency, its physiology, genetic variants, distribution and interaction with cultural adaptations to malaria.

The volume's 16 well-referenced contributions are arranged under three section headings [Table of Contents]. The first section explores the molecular genetics, biochemistry, epidemiology and clinical sequelae of G6PD-deficiency. In Chapter 1, by Gaetani and Ferrans, describes the

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basic biochemistry of oxidative stress and G6PD-deficiency, the G6PD alleles, their properties and roles in producing the deficiency. A well-referenced table classifying the numerous G6PD variants accompanies the discussion and is particularly useful. In another excellent chapter, Turrini et al. (Chapter 2) detail the biochemistry of favism, the hemolytic crisis following consumption of fava beans. The authors lay the biological basis for a co-evolved dietary adaptation as well as presenting evidence for their own novel hypothesis that auto-antibodies facilitate the antimalarial effects of G6PD-deficiency. The first section concludes with two chapters on G6PD morbidity. The first of these (Chapter 3), an epidemiological discussion of “favism, neonatal jaundice, and infection-induced acute hemolytic anemia,” is instructive although somewhat not in keeping with the focus of the volume. In the final chapter of this section, a case-control study of uncomplicated and severe malaria in Africa, Ruwende et al. refocus our attention on the selective advantage to malaria conferred by G6PD deficiency providing us with odds ratios to estimate the relative risks of diseases.

The second section is a somewhat uneven set of chapters that discuss the possible mechanisms of antimalarial protection in G6PD-deficient individuals as well as the related and more general subject of dietary and medicinal oxidant induced protection. The three initial chapters of the section discuss the damaging effects of reactive oxygen species on the red blood cells and malaria parasites. In Chapter 5, Scott and Eaton hypothesize that G6PD deficiency provides protection against malaria by the premature aging and consequently to the destruction of host red blood cells. This mechanism is somewhat analogous to the differential destruction of sickled red blood cells. However, in this model the accumulation of loose heme and iron in infected cells of G6PD deficient individuals leads to oxidant stress and aging. Har-El and Chevion (Chapter 6) follow with a detailed description and discussion the chemistry of iron in reference to oxidative stress in infected red blood cell. Completing the triad, Golenser (Chapter 7) describes how oxidative stress can lead to damage to the host cell as well as to the parasite. The final chapters of Section II explore the use, mechanisms and co-evolved human use of oxidant-inducing plants as protection against malaria. Etkin's (Chapter 8) excellently referenced and noted summary of indigenous pharmacopeias shown to have antimalarial (oxidative) action begins the next triad of the section. Etkin argues that the use of medicinal and dietary use of oxidant-containing plants is the cultural analog to G6PD-deficiency, producing the same effect but at a lower cost. In Chapter 9, Jackson attempts to provide a conceptual framework for understanding the evolution of human-plant-parasite interactions. Closing the section, Greene (Chapter 10) addresses the roles of various nutrients with reference to the notion that dietary patterns are a co-evolved mechanism for potentiating the antimalarial effects of G6PD-deficiency.

The final section includes six essays that variously discuss historic and genetic data related to the distribution of G6PD-deficient alleles in southern Italy and Sardinia. In Chapter 11, Tognotti discusses the spread of malaria in Sardinia. In one of the more ambitious chapters, Tagarelli et al. (Chapter 12) explore historic, orographic and genetic factors related to distribution of malaria G6PD in Calabria. In Chapter 13, Astolfi et al. (Chapter 13) suggest that the G6PD and thalassemia balanced polymorphisms have been maintained by differential fertility and survival. Sanna et al. (Chapter 14) discuss the origin and epidemiology of malaria in Sardinia as well as malaria's distribution in relation to G6PD deficiency. Danubio (Chapter 15) describes “methodological aspects of the biodemographic approach” with a brief discussion of how this approach might be applied to understanding the distribution to G6PD alleles. In Chapter 16 Gloria-Bottini et al. explore the sequence of genetic adaptations to malaria, focusing in particular on the interaction between G6PD-deficiency and thalassemia.

The final chapter (Chapter 17) is an attempt by the editors to place each chapter and section in perspective. While I greatly appreciated their efforts, I could not help but wonder if the readers would have been better served by editors' comments preceding each of the three sections. In addition, a chapter more generally discussing the pathogenesis of malaria as well as one or two chapters on G6PD in Africa would have been very instructive. Finally, given the varied

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backgrounds of the contributors to and the potential audience of this volume, abstracts preceding each chapter as well as a glossary at the end of the volume would have been helpful.

The volume has a recurring theme that human adaptation to malaria is biological and cultural. That theme arises from the often-cited evidence that diets that include oxidant-containing plant foods as well as therapeutic regimens that lower erythrocyte redox capacity, maximize the antimalarial protection of red blood cells in general and G6PD deficient cells in particular. While that point is well made, I have some concerns that that theme, like the title, does not generalize to other human adaptations to malaria (e.g., sickle-cell trait, the thalassemias). Indeed, the volume's focus on diet might leave some reader believing that oxidative stress is the only mechanism of resistance to malaria. While this might seem a minor point, it evinces the broader scope of human adaptation. In fact, in reading the volume, I sense two intertwined stories being told. One is the role of G6PD in the context of cultural and biological adaptations to malaria, the other the story of favism and acute hemolytic anemia in the context of the genetic legacy of a biocultural adaptation to malaria. Here again these intertwined stories recall the editors' concerns that public health concerns might be better addressed understanding the biological and cultural bases of human adaptation.

Overall, Greene and Danubio have produced an informative volume that can be recommended to anyone interested human adaptations to malaria or disease in general. Researchers, students, biochemists, geneticists, malariologists, and anthropologists will benefit from the references and tables as well as from the thoughtful effort to integrate biology and culture. For, as this volume demonstrates, understanding the human experience and struggle with malaria truly requires an understanding of the interaction of biology and culture.