

Rabies in Bats: Natural History and Public Health Implications. DANNY A. BRASS.
Pp. 335. 1994: US\$49.95 + US\$20.00 postage. ISBN 0 9637045 1 6.

The layman is rightly fearful of rabies and unjustifiably afraid of bats. At first sight Dr Danny Brass has brought together two topics which few except specialists would find appealing. But to overlook this book would be to miss a great opportunity to delve into the world of bats, the only mammals that can fly: to read about the habits, versatility and prowess of these fascinating but much maligned creatures. Of course, as with terrestrial mammals, bats are capable of carrying diseases such as rabies, but in rabies endemic areas one is far, far more likely to be bitten by a rabid dog than by a rabid bat.

Rabies in Bats: Natural History and Public Health Implications is a 335 page volume packed with well written and exciting to read facts. It is a scientific book – there are 47 clear and relevant tables, 69 well drawn or photographed figures, and over 1500 references but, where the reader may be unfamiliar with certain biological concepts required for appreciation of a particular discussion, explanatory notes have been provided to bridge the gap.

The 25 chapters are divided into five sections – Rabies: Disease and Nature of the Infective Process, Vampire Bats and Rabies in Latin America, Insectivorous Bats and Rabies in North America, Rabies Infection in Old World Bats, and Public Health Concerns. The author correctly describes the distillation of the available literature on rabies in bats as a Herculean task – his references range from the sixteenth century to 1994.

As a scientist with some 20 years experience in the rabies field, I looked for legitimate adverse criticism of the book but could find none. Although it is aimed to attract physicians, veterinarians and public health authorities, I recommend it to everyone who has an interest in bats and particularly to those who handle bats. Bat rabies is recognized in Africa, the Americas and Europe and by reading this book one can learn of the risks and how to reduce them. It is a handsome book, reasonably priced and right up to date.

ARTHUR KING
Central Veterinary Laboratory
Weybridge, Surrey, UK

Principles of Exposure Measurement in Epidemiology. B. K. ARMSTRONG, E. WHITE, R. SARACCI. Pp. 351. Oxford: Oxford University Press, 1994 (paperback). ISBN 0 19 262070 7.

Books with titles such as this can sound off-puttingly technical and specialized. This one, however, is mostly not those things. Indeed, it is pitched nicely, and is nicely timed. Its re-release two years after initial publication, this time in paperback, suggests that it has found a responsive market.

The book covers a wide sweep of issues that are important in modern non-infectious disease epidemiology, but treats none of them in excessive detail. Its overall balance reflects the catholic research experience of its three authors – senior academic and research epidemiologists, all. Two questions arise, though. First, why is a book oriented to non-infectious disease epidemiology being reviewed in this journal? Secondly, how important is the topic anyway?

In answer to the first question, it should interest infectious disease epidemiologists to reflect on the historical strengths of their line of research. Each infectious disease has a necessary but usually not sufficient causal agent, the infecting agent. As the authors point out on the first page, nineteenth century epidemiology was grounded in microbiology and its practitioners generally had substantial training or experience in that discipline. The measurement of microbiological 'exposures' in relation to disease was, in principle, relatively straightforward: specific organisms could be isolated and cultured, there was usually little time lag between being infected and being clinically affected, serological testing afforded a retrospective measure of earlier exposure, and (they might also have said) vaccination provided a ready basis for controlled trials of the effect of exposure avoidance.

The answer to the second question extends that storyline. Modern non-infectious disease epidemiology, with its ever-expanding interest in a profusion of risk factors (i.e. 'exposures'), has proliferated rapidly over the past three decades. Yet it has never really paused to examine systematically the particular difficulties posed by exposure measurement. Indeed, its pioneering

research success – with occupational exposures to potent carcinogens (X-rays, chemical dyestuffs, asbestos), cigarette smoking, alcohol, hypertension, and so on – needed little sophistication in exposure measurement. The large observable effects, even if imprecisely estimated, were robust against the erosion and biases attendant upon imperfections in exposure measurement.

These days, as epidemiologists struggle with more complex, less blatant, aetiological effects, greater care is needed with exposure measurement. This book provides a clear and rational cataloguing and exposition of the problems, and of their minimization – via both study design and, to a limited extent, data analysis. There are chapters on the main methodological problems, including the sources of measurement error, measurement validity and reliability, and enhancement of response rates. There are chapters on questionnaire design, interview techniques, job history extraction, diaries, medical records, the use of biological measurements in relation to endobiotic and xenobiotic chemicals (e.g. oestrogens and DDT, respectively), and the measurement of the external environment. Each chapter concludes with an excellent one-page summary.

I have one criticism. The book implies that the only epidemiology that really counts is ‘analytic’ epidemiology, gathering data *de novo* at the level of the individual. Yet, epidemiologists have relied, and still rely, on population-level studies of the correlation between exposure and outcome. Indeed, one of the authors (BKA) long dined out on just such a study, of national per capita dietary consumption and cancer rates. These (widely mislabelled) ‘ecological’ studies are often important for at least two reasons beyond their lowly role as hypothesis-gathering curtain-raiser.

First, for widely shared exposures (such as urban air pollution, water fluoridation, or ‘population mixing’ à la Kinlen) it is either not possible or not relevant to measure exposure at the level of the individual. Secondly, as Rose pointed out, the exposures which account for most of the variation in disease risk between individuals may not account for the often more important (in public health terms) variation between populations). The Intersalt study has shown us how the relationship of sodium to blood pressure is more evident between than within populations.

There is, therefore, a further set of issues and principles that needs to be addressed in relation to measuring exposure at the population level. Perhaps we should look forward to a second edition of this very worthwhile book.

A. J. McMICHAEL

*Department of Epidemiology and Population Sciences
London School of Hygiene and Tropical Medicine*