Book Reviews

Accounting for Population Growth

The Modern Rise of Population. THOMAS MCKEOWN. Academic Press, New York, 1976. vi, 168 pp., illus. $14.50.

The history of mankind since the 18th century is one of increasingly fast population growth. The causes of "the modern rise of population" have never been fully ascertained. Conventional wisdom long had it that the lowering of mortality that occurred was the result of improving standards of living resulting from industrialization and urbanization and of the progress of hygiene and medicine. This book gives an overall version of a new orthodoxy, which McKeown and his colleagues have been presenting since 1955 in a series of influential articles in the journal *Population Studies*.

At the onset of the book, McKeown states that "while the discussion will be based on European, and particularly British, experience, it is the remarkable increase in world population as a whole that it seeks to explain" (p. 1). But the point of view remains peculiarly English, and references to other developed countries or countries developing today are very sketchy. McKeown presents the familiar graph of the accelerating trend of world population growth. On the even more dramatic graph for England and Wales, a linear trend is used to represent the largely obscure history between the 11th century, when an estimate based on the Domesday Book yields approximately 1.5 million people, and 1700, when the equally uncertain estimate is 5.5 million. A clear inflection appears on the curve in the 18th century. Such graphs are somewhat misleading, for they hide the irregularity of the trends and whatever large cutbacks of population may have occurred.

Any explanation of the decline of mortality has to account for the early date at which the decline began. McKeown argues that medicine and public health were essentially ineffective before the improvement of water supply, food hygiene, and sewerage toward the second half of the 19th century and that industrialization and urbanization led to human concentrations that favored disease. Drawing his evidence from the longest available series of data on deaths by cause, that for England and Wales, which goes back to 1838, he makes clear (i) that the mortality decline resulted primarily from the reduction of infectious diseases; (ii) that a change in the virulence of microorganisms or in human resistance provides no general explanation of the decline of infectious diseases; (iii) that the decline of water- and food-borne diseases, resulting from reduced exposure to infectious organisms, occurred only with the development of public health at the end of the 19th century; and (iv) that medication and preventive measures could not have accounted for a reduction of the most important airborne diseases—most of all not tuberculosis.

There is a proven relationship between infection and malnutrition, and it is often difficult in practice to allocate the respective roles of these factors in specific deaths. The outcome of an infection will depend on the nutritional state of the victim. McKeown quotes from a World Health Organization report: "For the time being, an adequate diet is the most effective 'vaccine' against most of the diarrheal, respiratory and other common infections" (p. 136). He concludes that an improvement in the nutritional state of the population was the single most important factor accounting for the rise of population:

> The chain of influences [limiting the rate of population growth] was broken during the eighteenth and nineteenth centuries when advances in agriculture brought an increase in food supplies. The improvement in nutrition which followed led to the decline of infectious diseases and to a reduction of mortality and growth of population [pp. 162–163].

Although nutrition is by no means the only factor McKeown recognizes—the richness of his argument is such that any alternative explanation will use the same material, weighing it differently—in his view it remains the key factor in the early phase of the mortality decline. And the problem with that explanation is not that an improvement in nutrition could not have such an effect, but that there is no evidence that such an improvement took place during the period at issue. It is certain that the total production of food grew, for importation of food did not become important before the middle of the 19th century and population was growing. But it is at least possible that the supply increased precisely because population was growing and that agriculture did no more than hold its own. There are no sure indications that food per person improved, either in quantity or in quality. McKeown comes close to circular reasoning: if mortality went down, it must have been because nutrition was improving. And the proof of better nutrition is that mortality was declining.

The main weakness of McKeown's argument is the lack of a comparative method. He is using national figures on causes of death for England and Wales and does not attempt to disaggregate his evidence or to look at data for other countries. It is true that the British evidence is the best available, but there are data for other countries, less complete and less early, to be sure, that do not necessarily confirm the English story. Thus, tuberculosis was declining in England from 1838, but the data available for New York, Philadelphia, and Boston (and whatever skimpy evidence exists for Paris) show no decline before 1880. It would be interesting to know whether London followed the same trend as the rest of Britain or whether there were different patterns for cities and country. McKeown attributes the decline of tuberculosis to increased resistance of the human organism owing to improved nutrition. Was this improvement restricted to rural areas? Is his explanation valid for England only, despite his universalistic claims?

One objection to an earlier statement of McKeown's thesis was that mortality declined also among the upper classes, where nutrition had been adequate, or at least food must have been plentiful. McKeown thinks that improved health in the aristocracy was mostly a result of the lower prevalence of disease in the population at large. Thus, tuberculosis among the well-to-do "declined because the disease had become less prevalent in the community as a result of a general improvement in nutrition" (p. 141). In arguing thus McKeown forgets that he has earlier concluded that less frequent exposure contributed little to the overall decline of tuberculosis mortality in the 19th century and that most adolescents

had encountered the infection but simply failed to contract the disease because of their resistance (pp. 118–119).

Here as elsewhere McKeown is reluctant to admit that various efforts aimed at improving health and prolonging life, independent of nutrition, could have had much effect. His arguments are impressive, but the question remains open. He claims that medical treatment, public health measures, and individual hygiene were almost completely ineffective in the early phase of population growth. What remains in doubt is whether the small effectiveness they had could not have brought about what was, after all, a very moderate and slow decline of mortality.

Much of the controversy about medical treatment has been concerned with smallpox. McKeown grants with reluctance that mass vaccination accounted for the elimination of smallpox but seems to say that it was not a very important disease anyway. "Since the mid-nineteenth century the decrease has been associated with only 1.6 per cent of the reduction of the death rate from all causes." This hardly seems adequate as an assessment of the role of what was long the most feared of the childhood diseases. Jenner was widely hailed as a benefactor of mankind for his discovery of vaccination, and no other medical innovation spread so quickly to the most remote parts of the world. It is probable that by mid-century the prevalence of smallpox had already been considerably reduced. McKeown also rejects summarily the possibility that inoculation played a role in the 18th century. No doubt the procedure was a dangerous one by today's standards, but it received the support of the best scientific minds of the time and may have saved many lives in the enlightened upper classes.

The role of public health and the effectiveness of efforts to improve environmental sanitation remain the large unknown in the picture. It will not do to assign as the date for the beginning of the public health movement the time when national public health statutes were first passed. There had long before been sustained efforts on the part of municipalities to regulate the disposition of garbage, street cleanliness, burial, industrial pollution, and so on and to impose such measures as quarantines and building codes. The importance of clean and abundant water, of sewerage, of open spaces in cities was recognized. It is hard to make a general assessment of these measures, but they must have encountered some success here and there. But there was no general understanding of disease transmission. And the accumulation of large numbers in cities may have resulted in a deterioration of sanitary conditions. McKeown believes on the whole that exposure to water- and food-borne diseases worsened before 1850.

With respect to personal hygiene and domestic services, it is certain that standards of cleanliness improved, bathing became more frequent, and cotton clothing that could be washed frequently came into general use. According to McKeown, it is unlikely that such developments contributed significantly to the decline of mortality except possibly in the case of typhus, which was borne by body lice, "for it is the condition of the water and food which determines the risks of infection" (p. 124). Even here, it is perhaps notable that the practice of filtering water was spreading. And typhus, though its importance is difficult to assess because it was almost eliminated by the time for which statistics become available, accounted for severe epidemics and was not a negligible disease.

This reviewer does not understand why McKeown believes that the disappearance of another vector-borne disease, the plague, had no effect on the beginning of the modern rise of population. The last major plague epidemic in Western Europe occurred in 1720 and the last in England in 1679. This disease has been invoked by historians as one of the reasons for the stagnation of population numbers from the 14th to the 17th century. According to figures quoted in this book, the three most severe epidemics of the 17th century in London would have been sufficient to reduce population growth by an average of half a percent per year—hardly a trivial amount. To explain the early phase of the modern decline of mortality a reduction of the exceptional mortality of epidemics (including typhus and bubonic plague) remains a contender. Here, too, McKeown's resistance to explanations that hinge on human efforts to improve the urban environment is apparent. He seems to attribute the disappearance of the plague to a factor other than direct human intervention, "the interruption of land trade routes" from Asia, an explanation he quotes from J. F. D. Shrewsbury. But that author credits mostly another factor, namely the near-elimination of the black rat in British cities as a result of the improvement of building materials and the storage of food. The foremost historian of the plague, J. N. Biraben, attributes its disappearance to the success of quarantine measures.

No single factor can explain the modern rise of population, as McKeown would be the first to admit. An accurate apportionment of the factors responsible is still out of reach. The present work presents a bold and provocative thesis, clearly stated. Other researchers will inevitably be stimulated to challenge it. This is a major service rendered to a field that is still shrouded in ignorance.

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Fossil Arthropods

Evolution and Morphology of the Trilobita, Trilobitoidea and Merostomata. Proceedings of a NATO Advanced Study Institute, Oslo, July 1973. ANDERS MARTINSSON, Ed. Universitetsforlaget, Oslo, 1975 (U.S. distributor, Columbia University Press, New York). 468 pp., illus. + plates. Paper, $51. Fossils and Strata, No. 4.

This book stems from a conference organized by David L. Bruton of the Paleontologisk Museum in Oslo that brought together 60 paleontologists and zoologists from 13 countries to discuss current research on fossil arthropods. A valuable cross section of current paleobiological research on fossil arthropods, the book will be of interest to zoologists and paleobiologists and, to a lesser degree, to stratigraphic paleontologists.

Remains of Paleozoic arthropods are abundant, but soft tissues and appendages are only rarely preserved. Consequently, knowledge of early arthropod anatomy relies heavily on the study of the diverse and exquisitely preserved trilobites and nontrilobite arthropods of the Middle Cambrian Burgess Shale and a few other deposits that yielded soft parts. Separate articles by H. B. Whittington and C. P. Hughes present a comprehensive reevaluation of the anatomy of some Burgess Shale arthropods. These studies are part of a larger research program on the Burgess fauna organized by Whittington at Cambridge University. J. L. Cisne summarizes some results of a stereoradiographic study of *Triarthrus*, a trilobite with preserved soft tissues and appendages, from the Ordovician. Whittington's and Cisne's anatomical studies revise previous views of primitive arthropod affinities by showing similarities between some trilobites and cephalocarid crustaceans. R. R. Hessler and W. A. Newman develop a comprehensive argument for the diphyletic origin of arthropods, incorporating the new data on trilobite anatomy. Their interpretation supports the view put forth earlier by O. W. Tiegs