

experiences associated with personal encounters. The justification of a choice is stated in terms of a conceptual scheme with many posits, but often the choice is made not on the grounds of logic but on the basis of emotional experiences in childhood.

About the integration of the three avenues toward truth, he states that the conceptual schemes in each of these realms are man-made fabrics, and each, individually, must stand the test of consistency and simplicity. An attempt to formulate a unifying hypothesis or theory that can bring together the essential elements of the three realms is a presumptuous undertaking. One must instead confront a specific deduction from the conceptual scheme of one category with a relevant deduction from another, and thus form an integrational statement that encompasses the three realms. Some deductions are unprofitably discussed when there is paucity of our knowledge concerning them in one or more realms. Thus, every thoughtful person must function at times as a lay physicist, at almost all times as a moralist, and at times as a lay theologian.

The many hours of thought engendered by this booklet clearly justify its cost and the hour of reading.

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## A Matter of Fertility

BRUCE E. TRUMBO

FAMINE — 1975! AMERICA'S DECISION: WHO WILL SURVIVE?

By William and Paul Paddock

Little, Brown, and Company, Boston, 1967 276 pp cloth \$6.50 paper \$2.35

The reviewer is associate professor of statistics and mathematics at California State College at Hayward. He holds the doctor of philosophy degree (1965) in mathematical statistics from the University of Chicago. He was a National Institutes of Health fellow in biostatistics at Stanford University in 1963-64.

Small children can sometimes endure tedious sermons by playing a word-counting game. Anyone who has ever played the game realizes that its recreational success depends on the selection of an appropriate word to be counted — usually a noun the relationship of which to the subject assures its overuse during the course of the sermon.

I recommend the word *catastrophe* to anyone who dedicates himself to reading every page of *Famine — 1975!* The book is heavily, even excessively, documented, but it is a sermon, a work of single-minded advocacy, rather than a treatise. It contains errors, some of them serious, but its central theme of impending disaster is plausible enough to deserve serious thought.

The Paddocks, of course, did not discover the potentially disastrous relationship between the fertility of humankind and the fertility of the soil. In 1798 the English economist Thomas Robert Malthus predicted eventual famine in his *Essay on the Principle of Population*, which a modern writer claims has remained "indispensable reading for anyone interested in the problem of undeveloped countries,"<sup>1</sup> even though the subsequent growth of agricultural technology has so far saved the world from the dismal future he predicted.

At the beginning of chapter nine, the authors summarize the key arguments that they develop in great detail in the first eight chapters. In essence these arguments are:

1. The underdeveloped nations have exploding populations and static agricultures.
2. The "Time of Famines" will be seriously in evidence by 1975, when food crises will have been reached in several of these nations.
3. The "stricken peoples will not be able to pay for all their needed food imports. Therefore, the hunger in these regions can be alleviated only through the charity of other nations" (p. 205).
4. The only important food in famine relief will be wheat, and only the United States, Canada, Australia, and Argentina grow significant amounts of wheat.
5. The United States, the only one of these four countries that has historically given wheat to hungry nations, is the "sole hope of the hungry nations" in the future (p. 206).
6. "Yet the United States, even if it fully cultivates all its land, even if it opens every spigot of charity, will not have enough wheat and other foodstuffs to keep alive all the starving" (p. 206).
7. "THEREFORE, the United States must decide to which countries it will send food, to which countries it will not" (p. 206).

The authors propose in chapter nine that the concept of "triage" be borrowed from military medicine to help provide criteria for the assistance of the starving nations, and they encourage the reader to take a grisly little multiple choice test in order to get into the spirit of deciding which nations will be aided. The agricultural, political, and demographic characteristics of each of seven nations are described briefly, and the reader is asked to vote for one of three choices: "Can't Be Saved," "Walking Wounded" (that is, will suffer, but eventually survive without aid), and "Should Receive Food."

The authors' choices are thoughtfully provided on page 222 for a check. India, for example, is written off as a loss, perhaps only because of the hopelessness of its overpopulation problem, or perhaps also because it stands poorly the test of one or more of six auxiliary factors to consider (military value to the United States) or to ignore (prospect of communist takeover). Pakistan, on the other hand, "should receive aid," presumably since it meets the ancillary criteria fairly well and will "survive" if and only if it does receive aid. A working definition of survival is never provided.

The argument that the hungry nations will be crucially dependent on the developed world for food in the middle of the next decade depends on two assumptions: (a) that they cannot curb their exploding populations and (b) that modern science cannot discover in time new sources or kinds of food. In view of the fact that the supporting evidence for each of these concerns is largely statistical, the disarmingly forthright remark on page 40 should not be overlooked:

In college I took two courses in statistics. The first I almost understood. The second was incomprehensible, but Professor Josiah Livermore closed the course with a piece of advice I have applied profitably many times: "When the statistics go against your reasoned judgment, throw the statistics out the window!"

The author's modesty and the professor's advice are both soundly based. The most

outrageous abuses of statistical reasoning and presentation are all too frequent in the early chapters of the book. Recognizing that not all readers are statisticians, I will exercise some restraint by criticizing only one point.

In a diagram on page 53, the authors invite a comparison of a graph of population *growth* (which goes up steeply) with one of *per capita* food production (which fluctuates, except for a gratuitous plunging *projection* beyond 1965). The latter graph, of course, includes population information, and so it alone tells how much each person has to eat, which is presumably the issue at hand.

But any criticism of the authors' interpretations of statistics offers small comfort, because the data on population and food supply presented in this book (or indeed almost any other data on these subjects) need little manipulation to bring into focus a most disagreeable picture. Furthermore, although it may be dangerous to assert categorically, as do the Paddocks, that no development in any of the "panacea" areas — synthetic foods, hydroponics, desalinization, oceanography, agronomy, contraception — will come in time to avoid worldwide famine by 1975, the authors validly point out that many scientists who have claimed that "something will turn up" have supposed it will turn up in someone else's field of investigation. For a scientist to find hope in his own data or research has been rare. (An exception is the guarded optimism of Dudley Kirk, who claims to detect trends toward a marked decrease in the birthrates of some underdeveloped countries during the next decade.)<sup>2</sup>

Those who try to predict food supply and population often yield to the temptation simply to extend present trends and rates into the future. Carried to extremes, such projections lead to the kind of statements frequently seen in Sunday supplement magazines that by the year 2000 there will be only X square inches of land per person or that people will be stacked around the earth in layers Y people deep. Clearly, drastic changes in trends and rates would take place long before such spectacular fecundity could be accomplished. Paul Ehrlich, a Stanford University population biologist, is quite blunt about this.

But, later or sooner, one thing is certain. The human population *will* stop growing. This halt must come through either a decrease in the birthrate, or an increase in the death rate, or both. A corollary of this is that anyone or any organization opposing reduction in the birthrate is automatically an agent for eventually increasing the death rate.<sup>3</sup>

One nonstatistical example of the possible error of projecting the status quo into the future is the supposition in *Famine — 1975!* that surplus food produced in Canada, Australia, and Argentina will continue to be unavailable to impoverished nations in spite of the moral, political, and economic pressures of an approaching worldwide famine.

In conclusion, I would like to draw from a consideration of the world population problem three lessons that ought to be of particular concern to Seventh-day Adventists.

First, for some years the church has been preaching its eschatological doctrine, with emphasis on everything from the falling of the stars in the past century to the ecumenical movement in this century. However much these events may reinforce the faith of those who are already convinced that the present order of things is nearly

ended, it seems clear that the traditional arguments of the church along these lines have been less than universally effective in evangelism. Meanwhile, it has become obvious to many informed people, on strictly scientific grounds, that population pressures are soon going to put present institutions, if not the human race itself, in jeopardy. Perhaps not all of the signs of the times have been published.

Second, the church has long advocated vegetarianism as a principle of health. It has claimed that sounder bodies and brighter minds result from the vegetarian diet. Perhaps these arguments would be more forceful if the desirable effects claimed were more conspicuously in evidence. However, starvation is dramatic enough to be understood by even the staunchest skeptic, and certain remarks made by the Paddocks suggest that the church may soon have unsuspected support. The authors point out (while discussing another issue) that soon "America's own consumption of food will have to be curtailed or altered in order to maintain the same level of food aid. Curtailment of meat is an example. Every pound of grain-fed meat a person eats takes four to twelve pounds of feed grain" (p. 209).<sup>4</sup> If the Paddocks' predictions of famine are correct, diet in the 1970's may become less a matter of "doctrine" and more a matter of subsistence for much of the world.

Third, the church has long emphasized medical work as "the right arm of the message," particularly as an evangelistic tool in primitive countries. In the minds of some, the humanitarianism of medicine and public health has taken on predominant importance. In a world where each life saved through medical means must soon be balanced by one lost through starvation, the morality of this sort of "humanitarianism" may be due for a reexamination. Perhaps the day is at hand when those trained in agriculture will have at least as much to contribute as those trained in public health or medicine. (The importance of agricultural training will not be a novel concept to those familiar with the writings of Ellen G. White.) A story related in *Famine — 1975!* (pp. 19-20) makes this point well.

One of the Paddocks tells of a friend who was a guest of the ruler of a semi-developed country. On her first visit she was sickened to see people along the rutted main street of the capital city "eagerly scooping up water out of the puddles, along with the horse manure and anything else that had happened to accumulate during the dry season," for drinking and cooking use. She asked the ruler why he permitted such conditions to exist when his country was prosperous enough to afford sanitary water facilities.

The ruler replied, "I know it is not pleasant to see people drinking from the ruts in the road, and we do have enough money at least to change things here in the city. But the problem is not that simple. Rather, I have visited other countries, especially India, to see what happens when a city gets pure drinking water. My decision was that when India learns how to feed all of the people who have been kept alive because of the good water, then I shall order a modern water system here." My friend was not convinced that this was right but she was intelligent enough to accept it as a thought-out policy.

The Paddocks are not plagued by any such uncertainty. They applaud the ruler's reluctance to initiate public health reforms as "a major factor why the population increase rate is not out of hand and why the nation . . . is relatively prosperous."

ADDENDUM. Since this review was written, Paul Ehrlich's book *The Population Bomb* (Sierra Club-Ballantine, New York, 1968, 223 pp., paper \$.95) has become available. In one chapter Ehrlich quotes *Famine — 1975!* extensively and devotedly, saying (p. 161) that it "may be remembered as one of the most important books of our age." Ehrlich's book does not seem to be just a reiteration of *Famine*, however, since he sounds some of the same warnings as do Rachel Carson (*Silent Spring*) and the conservationist Sierra Club concerning "the progressive deterioration of our environment [which] may cause more death and misery than any food-population gap" (p. 46). A cursory examination leaves me with the impression that, compared with the Paddocks' *Famine*, Ehrlich's *Bomb* is less statistical, more philosophical, and equally fervent.

#### REFERENCES AND NOTES

- 1 RICHARD T. GILL, *Evolution of Modern Economics* (Englewood Cliffs, New Jersey: Prentice-Hall, 1967).
- 2 DUDLEY KIRK, World Population: Hope Ahead, *Stanford Today* 8 (winter 1968).
- 3 PAUL R. EHRLICH, World Population: A Battle Lost? *Stanford Today* 2 (winter 1968).
- 4 It does not seem likely that all cattle production will become economically unfeasible, since certain land has always been (or has become, through overgrazing and resulting erosion) suitable only for cattle grazing.

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## Problems in Darwinism

ARIEL A. ROTH

### MATHEMATICAL CHALLENGES TO THE NEO-DARWINIAN INTERPRETATION OF EVOLUTION

Edited by Paul S. Moorhead and Martin M. Kaplan

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Doctor Roth is chairman of the department of biology at Loma Linda University and a member of the Geoscience Research Institute at Andrews University, Berrien Springs, Michigan. He received the doctor of philosophy degree (1955) from the University of Michigan.

This report of a symposium held at the Wistar Institute of Anatomy and Biology, April 25 and 26, 1966, outlines some of the problems and questions that can be raised about the currently accepted mechanism for evolution (neo-Darwinian evolution). These problems are presented by the use of mathematical models based on the concepts of modern genetics. The formal presentations of the symposium are enriched by what appears to be a verbatim record of the often spirited discussions during and following each presentation.

The symposium was organized as a result of a "heated debate" that had developed between four mathematicians, Drs. Murray Eden, Marcel Schützenberger, Stanislaw