interesting (especially for readers of morbid temperament) and generally well written and well footnoted, but the rather loose structure of the book prevents the assembled material from being put together in a useful way. It may safely be admitted that in any given attack civil defense would save some lives and would not save all lives. The question of effectiveness must in the end be made quantitative: How many lives (and how much of our economic system) would be saved by civil defense in a nuclear attack, as a function of the size of the attack and of the cost of the civil defense system? The question must be put this way because we need to judge whether the protection is worth the cost (anyone who thinks cost is irrelevant should ponder the damage that is being done to the nation by the present level of military expenditure) and also because, in order to estimate an opponent's response to our civil defense program, we need to know how easily he could negate our defense by increasing his offense. It is difficult to be quantitative about these problems, but that is an essential part of the burden of proof.

I am not an expert on shelter design, radiation biology, or the sieges of Budapest (to which one chapter is devoted), so I cannot judge the accuracy of much of this book, but I did note one relevant error. In discussing the time needed for entering shelters, Wigner says, "Certainly, a minimum warning time of about fifteen minutes could be guaranteed *under all conditions*" (italics his). This is true for an attack by intercontinental ballistic missiles, but not for an attack by ballistic missiles launched on depressed trajectories from submarines. The administration has raised the possibility of just such short-warning attacks as justification for an ABM defense of our bomber bases; Wigner may not agree with the administration (in this he would be in good company), or he may have some reason to believe that people are less vulnerable than bombers, but then he should say so. Also, I would have liked to see some evidence for the cost estimates given in the article on shelters by J. C. Bresee and D. L. Narver, Jr.; I have seen much higher estimates published by J. E. Ullman (see *Science and Citizen*, Feb.–Mar. 1966, p. 15). I had the disturbing feeling in reading these articles that most of them had been lying in desk drawers for two or three years and had been perfunctorily updated. For instance, the article on active and passive defense by Albert E. Latter and E. A. Martinelli describes Nike-X as the *dernier cri* in ABM systems. Surely these authors have heard of Sentinel and Safeguard.

An aura of unreality surrounds the book. The authors are not only convinced of the need for civil defense; they seem also to be convinced that the American people can be awakened to this need by a little more reasonable persuasion. Thus they can seriously describe civil defense programs of an utterly preposterous scale or scope as if these programs were just about to be implemented. Irving L. Janis discusses the partial dispersal of U.S. industry, with "attractive inducements" to be offered to workers to move with their jobs. Latter and Martinelli suggest spending $35 billion for fallout and blast shelters. Bresee and Narver want to put a grid of tunnel shelters under all large American cities, at a cost of the same order of magnitude. Ira C. Bechtold wants to establish an industry producing a multipurpose food, which after a year's storage in shelters could be eaten here or shipped abroad, and he also quotes with apparent approval the suggestion of Oskar Morganstern that retired scientists, engineers, accountants, and so on be induced to live in areas least likely to be targets, so that they can assist in the recovery of basic industries.

Ironically, the emphasis on huge civil defense programs that aim at a high degree of effectiveness may stand in the way of modest and inconspicuous measures that might at least ameliorate the damage done by an attack. Do there exist detailed plans for reinstating electric power and food deliveries after an attack? I gather from the article by Jack Hirshleifer that such planning is in a worse state than is shelter design. At least the convening of a small task force of economists and engineers to map out such plans quietly (without redesigning the economy) would not escalate the arms race.

I am admittedly not disposed to be enthusiastic about civil defense, especially after having spent half a year in the fight against the ABM. However, I do think that civil defense is an important and complicated problem, and as a collection of source material this book will make a useful contribution to discussion of the subject. It would have been more useful if presented with less zeal.

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Furthering Birth Control

Family Planning in Taiwan. An Experiment in Social Change. RONALD FREEDMAN and JOHN Y. TAKESHITA. Princeton University Press, Princeton, N.J., 1969. xxx + 506 pp., illus. $15.

There is widespread and growing agreement that rapid population growth is a major threat to human well-being in this latter half of the 20th century. There is less agreement about how low the growth rates ought to be, how quickly they must be reduced, and what social policies and programs could best bring about the necessary changes. A lively controversy on these questions has been going on for some time now.

The major split in this debate is between those who think that massive voluntary family-planning programs (offering contraceptive information and services to all who want them) are a logical and adequate first step toward population control, and those who think such methods fall so far short of what is needed that to divert attention and resources to them is a deterrent to progress. Concretely, the proponents of family planning, while stressing the importance of family limitation, would leave to the individual or the couple decisions about the number and timing of their children and would help them achieve their personal desires in this matter. The critics of family planning argue for social policy and engineering to bring individual fertility into line with the demographic, economic, and social needs of the community, or indeed of the whole species. Family planners lean heavily on improvements in contraceptive technology and logistics, their critics on a revamping of the motivation to reproduce and of social institutions.

Family Planning in Taiwan is an impressive contribution to an understanding of the points at issue. It is a detailed and highly competent evaluation of one of the largest, most sophisticated, and presumably most successful family-planning experiments to date. With respect to the foregoing controversy, the monograph provides strong support for the family-planning approach to population control. Yet the overall tone is one of moderation. The authors are aware that the achievements of the Taiwan program were limited and that what was done there might not be done so easily or at all in some other high-fertility society.

The family-planning experiment in question was carried out in the city of

Taichung in 1963, with follow-ups and evaluative studies continuing into 1967. Eighteen trained health workers and nine supervisors were organized within the Taiwan Provincial Health Department to try to extend contraceptive information, advice, and supplies to as many as were interested of Taichung's 36,000 wives aged 20–39. Their efforts included approximately 12,000 initial home visits, 500 neighborhood group meetings, and as many as 20,000 follow-ups of various kinds. Ten health clinics throughout the city provided the complete range of contraceptive services and supplies; except for the intrauterine device (IUD) and the oral pill, supplies were also available from the fieldworkers at home visits and group meetings. A nominal charge was made for all contraceptive supplies, except to indigent persons.

The evaluation of the effects of this program involved an experimental design too complex to describe in detail, but had the following important features: (i) An intensive citywide sample survey was carried out to measure conditions before the program went into effect. (ii) The methods of disseminating information were varied from neighborhood to neighborhood. In some neighborhoods all the adopted methods were used: personal visits with husband and wife, mailings, and group meetings. In other neighborhoods the visits with husbands were omitted, in others only mailings were used, in some nothing at all. These variations were systematic; the city was divided into three sectors, and a different proportion of neighborhoods in each were given the full treatment. The application of four different treatments in three different "density sectors" yielded 12 different input intensities in all. (iii) There was a follow-up of individuals by means of record-linkage and reinterview, so that before-after comparisons could be made on an individual rather than only a group basis.

The detailed analysis is based on at least six different sets of data, of differing scope and quality. Often a substantive conclusion is borne out in two or more sets of the data, and this "triangulation of proof," to use Zeisel's phrase, gives a quality of firmness to many of the conclusions that is missing from sociological reports based on a single sample survey or other single source of data.

Among the many interesting conclusions, these stand out:

1) The program was followed by an increase in the proportion of married women using contraception (from 19 percent before the campaign to 33 percent two and a half years later), by an accelerated decline in Taichung's fertility level (a decline more rapid than in other cities in Taiwan), and by lower fertility for the "acceptors" than would have been expected on the basis of their age and past fertility. The authors do not claim conclusive proof of a cause-effect relationship between the program and these changes, but they have little doubt that the program played an important role.

2) Many of the acceptors were reached indirectly, through word-of-mouth diffusion, rather than directly through the program. Thus a substantial number of women came to clinics for contraceptive advice from outside the city of Taichung and from neighborhoods within the city that the program did not enter or did not reach until later.

3) Because of diffusion, differences in acceptance rates by treatment and by density sector were not as large as expected.

4) The IUD was chosen by the majority of acceptors, and was the method most closely associated with the diffusion noted above.

5) Group meetings, when conducted well, were effective in gaining acceptance, especially by women of lower socioeconomic status. The mass mailings and the inclusion of husbands in personal interviews with their wives were not so effective.

6) Individual acceptance of contraceptive service was correlated more closely with demographic variables (age, number of children, number of children in relation to the number wanted) than with modernization variables (education, newspaper reading, income, and the like). In other words, women who needed help with fertility control tended to accept the program services, regardless of their socioeconomic backgrounds. The program's ability to reach more traditional and lower-status women is considered especially significant, because such women were least likely to have been practicing contraception before and because they constitute a very large proportion of Taichung's population.

7) The program was most successful among older women with several children already. The authors point out that it was not therefore ineffective in preventing substantial numbers of births, for these acceptors were women of above-average fertility in the past, and many of them were young enough and presumably fecund enough to have continued reproducing at a high rate. In addition, as time passed larger numbers of young women, with fewer children, began to avail themselves of the program services.

8) The termination rates for IUD use were much higher than had been expected, but they were lower than would have occurred with any other contraceptive technique. And, for whatever reasons, women who discontinued using the IUD were highly successful in continuing to avoid pregnancy by other means.

Does the Taichung experiment imply that the voluntary family-planning approach is the answer to the problem of population growth? Freedman and Takeshita avoid such exaggerated optimism. They recognize, to begin with, that in many ways Taichung is not typical of underdeveloped areas. Taiwan is well along the road to modernization, and Taichung even more so than the island as a whole. The Ota ring, an older Japanese IUD, was widely known there; 84 percent of the women aged 20–39 in Taichung were aware of it before the program started. This may have had a lot to do with the popularity of the newer IUD and the relative ease with which news of it spread through informal channels of communication. Also important is the fact that no measurable opposition was aroused by the program; in not a few nations, developed and underdeveloped, ethnic, religious, racial, and political opposition to family planning is substantial.

Thus as the authors themselves see it, the program helped simply to speed up a process of social change that had already begun. Even so, the results were but moderate. After two and a half years of the experimental effort, 33 percent of married women 20 to 39 years of age were using contraception; in the U.S. the figure would be closer to 90 percent. Moreover, the program was less successful at the lower end of the age range, and really effective population control requires that women begin marriage with small family aspirations and the means to achieve them. It is interesting to speculate whether a different and more far-reaching program would have had greater effect. Suppose strong efforts had been made to convince women of the advantages of small families, instead of merely accepting and helping to implement their wishes in the matter. Suppose that the mass media had been utilized in an all-out publicity campaign. These mea-

sures were not used, so as to avoid stirring up possible opposition to the whole effort, and before the fact such a decision may have been a reasonable one. In retrospect, it seems that the program could have proceeded in a less gingerly way.

One could speculate endlessly about what might have been done, and what the effects might have been. It is the great merit of *Family Planning in Taiwan* that it concentrates on telling in great detail what actually was done, and as far as technically possible what the actual effects were. At least one basis for optimism about the future of population control is the fact that scientific competence of such a high order is being used to monitor and evaluate pioneering efforts in the field. The successes and failures of the Taichung program are presented for all to see and reflect on. Similar studies in other countries, which the authors deem essential, should sharpen our understanding of both the capabilities and the limits of the current family-planning approach.

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Molecular Embryology

Gene Activity in Early Development. ERIC H. DAVIDSON. Academic Press, New York, 1969. xii + 376 pp., illus. $12.50.

The concept of the gene has come a long way since Mendel. Originally genes were factors whose distribution was governed by unknown agents. These agents were soon found to be the chromosomes. The physical identity of the gene remained unknown until the role of DNA was discovered. With that, genes became nucleotide sequences that could be translated into the particular amino acid sequence of a given protein. It would certainly seem that we have finally reached the end of at least one path Mendel started us on, and that the gene has been identified.

If genes are nucleotide sequences that give rise to particular proteins, then strictly speaking this book does not say much about gene activity. In fact, with the exception of a few "genes" governing the production of nucleolar RNA, no bona fide genes are mentioned. The problem is that the title is ahead of its time. A more accurate title would have been "Ribonucleic Acids in Early Development." There is a lot here on that subject. In fact, the abbreviations RNA and DNA appear on about three-quarters of the pages. Essentially this is a review of the abundant literature that has now accumulated on the characteristics and changes in RNA during early development of molluscan, echinoderm, and amphibian embryos. This is an area in which Davidson has made important contributions.

In a way this book reviews the beginnings of attempts by embryologists to examine development from the inside out. In the past most of molecular biology has been directed toward determining the chemical basis for a particular phenotype. The approach here is the reverse. The nucleic acid changes that occur during development are becoming known; the question is now, What phenotypic character do they control?

The "early development" of the title in general refers to development through gastrulation. The nucleic acid changes that occur during this period are placed in proper perspective with good summaries of the pertinent areas of experimental embryology. There is also a large section on oogenesis, a part of embryology that is often ignored yet obviously important if the developmental process is to be understood.

This book is the first major attempt to bring the results of experimental embryology and molecular biology together in a coherent whole. It will be indispensable to anyone who wishes to know what has been going on in the early development of molecular embryology.

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Natural Communities

Habitats and Territories. A Study of the Use of Space by Animals. PETER H. KLOPFER. Basic Books, New York, 1969. x + 118 pp., illus. $3.95. Basic Topics in Comparative Psychology.

Elton once stated that "while ecological work is fascinating to do, it is unbearably dull to read about." He also warned against making ecology consist in "saying what every one knows in language that nobody can understand." After 40-odd years his statement is still true, but his warning has a quaint, old-fashioned ring about it; for although we know little more than we did in 1927 about the way communities are organized, we do have new and sophisticated ways of saying the same old things. Such treatment, while giving the subject a spurious air of respectability, is particularly unfortunate in the present book, which, as one of a series on Basic Topics in Comparative Psychology, is supposed to appeal to students of psychology and the social sciences.

The author's intentions are laudable enough: he wants to stop those who write about human behavior from dressing up preconceived notions as justifiable inferences from the behavior of other animals. Although he would probably agree with Tinbergen [*Science* **160**, 1411–18 (1968)] that it is the methods rather than the results of ethological studies that such writers should attend to, he himself dishes up a conceptual macedoine that is unlikely to be digestible by readers whose diet may not have included biology. Such readers will certainly see that ideas about animals' use of space are too varied to lead to satisfactory conclusions of any kind, but are unlikely to get much out of learning how ecologists measure bird species diversity—beyond noting that they seem unsure of the difference between prediction and correlation.

The prevailing lack of rigor in the study of natural communities is also apparent from other statements. Merely to "infer [from descriptive data] the explanation for the continued coexistence of related species" (p. 6) counts as a form of experimentation, and discussions of the competitive exclusion principle ignore the recognized difficulty that one is dealing either with a tautology or an unfalsifiable hypothesis. (It is not too surprising that this principle has led to less of a renaissance in ecology than was at one time predicted.) Miller's paper on competitive exclusion [*Adv. Ecol. Res.* **4** (1967)] is only one of the odder omissions from the references, few of which go beyond 1966.

Results with birds and mammals, before being extended to human beings, must "account for all relevant evolutionary and ecological factors" (p. 102). Strictly interpreted this advice amounts to an indefinite taboo on a comparative approach to human behavior, which is far from the author's intentions. More loosely interpreted, however, his advice might reduce the number of simplistic explanations of mental illness, crime, riots, and war (between nations and sexes) and free certain grant applications from their more dubious claims.

With the author's main theme one