

certainly require much more information about the three-dimensional structure of the ribosome than is now available.

References and Notes

1. G. S. Stent, *Science* **160**, 390 (1968).
2. F. Lipmann, *ibid.* **164**, 1024 (1969).
3. J. D. Watson, *Bull. Soc. Chim. Biol.* **46**, 1399 (1964).
4. A. T. Tissieres, J. D. Watson, D. Schlessinger, B. R. Hollingworth, *J. Mol. Biol.* **1**, 221 (1959).
5. C. G. Kurland, *ibid.* **18**, 90 (1960); J. E. M. Midgely, *Biochim. Biophys. Acta* **108**, 340 (1965); W. M. Stanley and R. M. Bock, *Biochemistry* **4**, 1302 (1965).
6. R. Rosset and R. Monier, *Biochim. Biophys. Acta* **68**, 653 (1963); G. G. Brownly and F. Sanger, *J. Mol. Biol.* **23**, 337 (1967).
7. T. Okamoto and M. Takanami, *Biochim. Biophys. Acta* **76**, 266 (1963).
8. I. Suzuka, H. Kaji, A. Kaji, *Biochem. Biophys. Res. Comm.* **21**, 187 (1965); S. Pestka and M. W. Nirenberg, *J. Mol. Biol.* **21**, 145 (1966).
9. M. R. Cannon, R. Krug, W. Gilbert, *J. Mol. Biol.* **7**, 360 (1963).
10. W. Gilbert, *ibid.* **6**, 389 (1963).
11. R. R. Traut and R. E. Monro, *ibid.* **10**, 63 (1964); R. E. Monro, *ibid.* **26**, 147 (1967).
12. A. L. Haenni and J. Lucas-Lenard, *Proc. Nat. Acad. Sci. U.S.* **61**, 1363 (1968).
13. J. P. Waller, *J. Mol. Biol.* **10**, 319 (1964).
14. E. Kaltschmidt, M. Dzionara, D. Donner, H. G. Wittmann, *Mol. Gen. Genet.* **100**, 364 (1967); G. Stöffler, *ibid.*, p. 374; —, V. Rudolf, H. G. Wittmann, *ibid.* **101**, 70 (1967).
15. R. R. Traut, P. B. Moore, H. Delius, H. Noller, A. Tissieres, *Proc. Nat. Acad. Sci. U.S.* **57**, 1294 (1967).
16. S. Fogel and P. S. Sypherd, *ibid.* **59**, 1329 (1968).
17. P. P. Moore, R. R. Traut, H. Noller, P. Pearson, H. Delius, *J. Mol. Biol.* **31**, 441 (1968).
18. S. J. S. Hardy, C. G. Kurland, P. Voynow, G. Mora, *Biochemistry* **8**, 2897 (1969); G. R. Craven, P. Voynow, S. J. S. Hardy, C. G. Kurland, *ibid.*, p. 2906.
19. C. G. Kurland, *J. Mol. Biol.* **18**, 90 (1966); S. J. S. Hardy and C. G. Kurland, *Biochemistry* **5**, 3676 (1966).
20. H. G. Wittmann, personal communication; R. R. Traut, H. Delius, C. Ahmad-Zadeh, T. A. Bickle, P. Pearson, A. Tissieres, *Cold Spring Harbor Symp. Quant. Biol.*, in press.
21. G. Mora, T. Pallaiah, L. Lutter, G. Craven, D. Donner, C. G. Kurland, unpublished results.
22. G. Stöffler and H. G. Wittmann, personal communication.
23. S. Brenner, F. Jacob, M. Meselson, *Nature* **190**, 576 (1961).
24. M. Meselson, M. Nomura, S. Brenner, C. Davern, D. Schlessinger, *J. Mol. Biol.* **9**, 696 (1964).
25. K. Hosakawa, H. Fujimura, M. Nomura, *Proc. Nat. Acad. Sci. U.S.* **55**, 198 (1966); T. Staehelin and M. Meselson, *J. Mol. Biol.* **16**, 245 (1966).
26. P. Traub, M. Nomura, L. Tu, *J. Mol. Biol.* **19**, 215 (1966); R. F. Gesteland and T. Staehelin, *ibid.* **24**, 149 (1967).
27. P. Traub and M. Nomura, *ibid.* **34**, 575 (1968).
28. P. Traub, D. Söll, M. Nomura, *ibid.*, p. 595.
29. P. Traub, K. Hosakawa, G. R. Craven, M. Nomura, *Proc. Nat. Acad. Sci. U.S.* **58**, 2430 (1967).
30. P. Traub and M. Nomura, *ibid.* **59**, 777 (1968).
31. M. Ozaki, S. Mizushima, M. Nomura, *Nature* **222**, 333 (1969).
32. A. Bollen, J. Davies, M. Ozaki, S. Mizushima, *Science* **165**, 85 (1969).
33. E. A. Birge and C. G. Kurland, *ibid.* **166**, 1282 (1969).
34. M. Nomura, S. Mizushima, M. Ozaki, P. Traub, C. V. Lowry, *Cold Spring Harbor Symp. Quant. Biol.* **34**, 49 (1969).
35. C. G. Kurland, P. Voynow, S. J. S. Hardy, L. Randall, L. Lutter, *ibid.*, p. 17.
36. P. Voynow, thesis, University of Wisconsin (1970); a paper summarizing these data is in preparation.
37. R. Traut, H. Delius, C. Ahmad-Zadeh, T. A. Bickle, P. Pearson, A. Tissieres, *Cold Spring Harbor Symp. Quant. Biol.*, in press.
38. P. S. Sypherd, D. M. O'Neil, M. M. Taylor, *ibid.*, in press.
39. F. H. C. Crick, *J. Mol. Biol.* **19**, 548 (1966).
40. R. W. Holley, J. Apgar, G. A. Everett, J. T. Madison, M. Marquisee, S. H. Merrill, J. R. Penswick, A. Zamir, *Science* **147**, 1462 (1965); H. Zachau, D. Dütting, M. Feldman, *Angew. Chem.* **78**, 393 (1966); J. T. Madison, G. A. Everett, H. Kung, *Science* **153**, 531 (1966); V. L. RajBhandary, S. M. Chang, A. Stuart, P. D. Faulkner, R. H. Hokinson, H. G. Khorana, *Proc. Nat. Acad. Sci. U.S.* **57**, 751 (1967).
41. C. S. McLaughlin, J. Dondon, M. Greenberg-Manago, A. M. Michelson, G. Saunders, *Cold Spring Harbor Symp. Quant. Biol.* **31**, 601 (1966).
42. B. F. C. Clark, S. K. Dube, K. A. Marcker, *Nature* **219**, 484 (1968).
43. J. Davies, W. Gilbert, L. Gorini, *Proc. Nat. Acad. Sci. U.S.* **51**, 883 (1964); L. Gorini and E. Kataja, *ibid.*, p. 487.
44. C. G. Kurland, *Advan. Protein Syn.*, in press.
45. S. Mizushima and M. Nomura, unpublished data.
46. H. Schaup, M. Green, C. G. Kurland, unpublished data.
47. I thank M. Nomura, P. Voynow, and C. Woese for their criticism. This work is supported by NIH research grants GM12411 and GM13832 and by funds from the Wisconsin Alumni Research Foundation.

The "Perfect Contraceptive" Population

The extent and implications of unwanted fertility in the United States are considered.

Larry Bumpass and Charles F. Westoff

Recent discussions of population policy have raised and sharpened the question of unwanted fertility in the United States (1). The issue is whether the elimination of unwanted fertility would have a significant effect on our rate of population growth, and the discussion has revolved in part around what might be called the demographic implications of "perfect contraception." We are not suggesting that such a technological development is in sight, or that, if it were,

we would not have to be concerned about problems of distribution and use. The "perfect contraceptive" population is simply a model in which couples can avoid having more children than they want and do not have children before they want them. In the broader sense we are visualizing the "complete fertility controlling population" rather than the "perfectly contraceptive population." The achievement of such a state of affairs might well require social pol-

icies for the development of more effective contraceptive techniques and more efficient distribution systems as well as the legalization of abortion on request. However, this article is focused on *implications* of the elimination of unwanted fertility rather than on specific policies necessary to realize this goal.

We make no artificial assumptions about fecundity; we assume that the current incidence of subfecundity (less than normal capacity to reproduce) in the United States will continue. Also, we are *not* assuming that every couple will practice contraception or that all couples will begin using contraception at the same stage of their marriage. The system is completely voluntary. The only condition we are imposing is that couples can control their fertility completely in the sense that they can, within the limits of physiological capacity and variability, have the number of children they want, when they want them. If a husband and wife prefer to have chil-

Dr. Bumpass is assistant professor of sociology at the University of Wisconsin, Madison. Dr. Westoff is professor of sociology at Princeton University, Princeton, New Jersey, and executive director of the National Commission on Population Growth and the American Future, Washington, D.C.

Table 1. Percentages of births occurring between 1960 and 1965 reported to have been unwanted, by birth order and race. The values in parentheses are numbers of births.*

Race	All	Birth order					
		1	2	3	4	5	6+
<i>1) Unwanted by both spouses</i>							
Total	17	4	6	18	25	39	45
White	14	3	5	17	23	36	39
Negro	31	9	17	24	37	51	61
<i>2) Unwanted by at least one spouse</i>							
Total	22	5	10	24	35	49	55
White	19	4	7	23	32	46	48
Negro	41	15	24	37	51	61	72
<i>3) Medium estimate, average of categories 1 and 2</i>							
Total	19 (4,264)	5 (1,090)	8 (1,020)	21 (792)	30 (532)	44 (328)	50 (502)
White	17 (3,091)	4 (839)	6 (779)	20 (602)	28 (397)	41 (215)	43 (259)
Negro	36 (1,108)	12 (234)	20 (229)	30 (180)	44 (131)	56 (107)	66 (227)

* The 1965 NFS double-sampled Negroes. Consequently, for measures computed for the total sample, the data for non-Negroes are weighted by a factor of 2. In this and all subsequent tables based on the NFS, the number of cases reported for the total are unweighted and represent the actual number of sample cases on which the statistics are based. Non-whites other than Negroes are included in the total.

dren right away or want a large family, they may use no contraception at all. On the other hand, if they wish to control their fertility (a virtually universal wish in the sense that practically all exposed couples in the United States use contraception sooner or later) (2), they shall be able to practice completely effective and completely acceptable contraception continuously. "Completely effective" means that the failure rate is zero; "completely acceptable" means that the use of contraception carries no costs of any kind—economic, social, or psychological—and that its use would be interrupted only for the purpose of conceiving. While such conditions are Utopian, the model provides a useful framework for assessing the implications of current levels of unwanted fertility in the United States for the rate of population growth.

Radically different policy implications flow from (i) the position that achieving a zero or near-zero rate of population growth requires changing the number of children couples want, and (ii) the position that eliminating unwanted births is sufficient. Consequently, it is important that we evaluate the number of unwanted births in the United States on the basis of the most recent detailed data available. Our estimates are based on the 1965 National Fertility Study (NFS), an interview survey of a probability sample of 5600 married women throughout the nation (3).

Measurement of Unwanted Fertility

Reliable reports on unwanted births are difficult to obtain, since the admission that a birth was unwanted reflects

on the respondent's ability to control fertility and perhaps also on the status of the child. Unwanted fertility was measured in the 1965 NFS on the basis of questions about the circumstances of each pregnancy. Women who reported the use of some contraceptive method preceding a pregnancy were asked, "Under which of these circumstances did this pregnancy occur?" A card listing the following categories was shown to the respondent:

- 1) While using a method and did not want to become pregnant at that time.
- 2) While not using a method but did not want to become pregnant at that time.
- 3) When stopped using a method in order to have a child.

Women who reported circumstances 1 or 2 were then asked, "Before you became pregnant this time, did you want to have a child (or another child) sometime?" and "Did your husband want to have a child (or another child) sometime?"

Women who reported not having practiced contraception prior to pregnancy were asked: "Was the *only* reason you did not use any method then because you wanted to have a baby as soon as possible?" Those who answered "No" were asked the same questions as the other group about whether they had wanted another child sometime.

Since couples are not always in agreement on the desirability of having additional children, alternative definitions of "unwanted" fertility are possible. A minimal definition would require that both spouses had been reported not to have wanted another child before pregnancy occurred. A broader definition would require only that one spouse had been reported not to have wanted an additional child. When husband and

wife disagree on this question, some couples will intentionally have another child, others will not. It seems reasonable to assume that the proportion of unwanted births lies somewhere between estimates resulting from these two definitions, and that the average of the two constitutes a best estimate. We use this estimate throughout the text, although the consequences of alternative definitions are reported in several tables for the reader's evaluation.

To what extent are these measures of unwanted fertility reliable and valid? As part of the 1965 NFS, a subsample of the original sample of women was re-interviewed 3 to 5 months later, to assess the reliability of survey data on fertility and family planning. The percentage of births classified as unwanted differs by 0.3 percent in the two interviews. Checks for internal consistency reveal that none of the women who reported that their last child was unwanted replied (to a different question) that they intended to have additional children. In addition, the NFS estimate is consistent with reports of other fertility surveys based on differing measurement techniques (4).

An indirect check on the validity of our estimates can be made in terms of contraceptive efficacy. When we consider women who are near the end of the childbearing stage (40 to 44 years of age), the percentage classified as having experienced at least one unwanted birth implies, even when allowance is made for underreporting, an average contraceptive efficacy that is improbably high (5). Realistic assumptions about the level of contraceptive efficacy of this population would very likely lead to a figure for the proportion who had experienced at least one unwanted birth that is higher than the estimate obtained by the measures used here (6). This is independent evidence that there is considerable rationalization in the report of unwanted births and that our estimates of unwanted fertility are not likely to be too high.

Incidence and Characteristics of Unwanted Fertility

In order to focus on the most recent picture for which data are available, we have limited the analysis in this section to births which occurred between the beginning of 1960 and the time of interview, the autumn of 1965.

It is evident from the data of Table 1 that unwanted births comprised a sub-

stantial proportion of total births during these years. Our estimates indicate that one-fifth of all births and more than one-third of Negro births between 1960 and 1965 were unwanted. As one would expect, the proportion of unwanted births increases rapidly with birth order. Almost one-third of all fourth-order births and one-half of all sixth- or higher-order births were unwanted; for Negroes the corresponding proportions are nearly one-half and two-thirds. This high level of unwanted births among Negroes indicates the magnitude of the burden of unwanted dependents that is borne by this population, but the problems of unwanted births are substantial among whites as well.

The incidence of unwanted births is negatively related to both education and income (Tables 2 and 3). In general, the proportion of unwanted births is approximately twice as high among wives with less than a high school education as among wives who have attended college. By income, the proportion of births reported as unwanted varies little for families whose 1964 income was over \$5000, but it is more than twice as high for families with

incomes of less than \$3000 as for those with incomes of over \$10,000. This differential is particularly marked among Negroes.

We have approximated the Social Security Administration's definition of poverty (7), and the results are presented in Table 4. Since family size is one component of that definition, many couples would not have been classified as poor were it not for their having had unwanted children. Consequently, the results indicate the coincidence of poverty and unwanted births rather than a propensity of the "poor" to have unwanted children. Among the "poor" in 1965, unwanted births constituted almost two-fifths of all births and three-fifths of all sixth- and higher-order births; among the "non-poor" one out of every seven births was unwanted among whites and one out of every five among Negroes (8).

Estimates for All Women

The foregoing analysis is based on a sample of married women living with their husbands in 1965; consequently, births to women not living with their

husbands and most illegitimate births are not represented (9). In the absence of reliable data on the subject, our procedures are based on the assumption that the incidence and birth-order distribution of unwanted births are the same for such births as for births reported by wives now living with their husbands. This undoubtedly is a bias in the direction of underestimating the extent of unwanted fertility.

We prepared our estimates separately by race and birth order and then summed them to obtain the total. We estimate that in the period 1960 to 1965 there were 4.7 million births that would have been prevented by "perfect contraception." These births represent one-fifth of all births during the period. Approximately 2 million of these unwanted births occurred among the poor and the near-poor, and half of these among the Negro poor and near-poor (Table 5).

Timing Failures

While the level of unwanted births is high, the data of Table 6 make it clear that many desired births are tim-

Table 2. Percentages of unwanted births (medium estimate) occurring between 1960 and 1965, by wife's education, by race, and by birth order. The values in parentheses are numbers of births.*

Wife's education	Total	White	Negro	Birth order for total					
				1	2	3	4	5	6+
Less than 12 years	26 (1,842)	21 (1,153)	42 (653)	5 (341)	11 (380)	26 (339)	31 (249)	42 (188)	54 (335)
12 years	16 (1,742)	14 (1,361)	28 (358)	4 (525)	6 (437)	20 (232)	32 (207)	48 (102)	44 (139)
College	13 (688)	11 (577)	25 (95)	4 (223)	8 (202)	16 (121)	22 (76)	42 (38)	45 (28)

* See footnote to Table 1.

Table 3. Percentages of unwanted births (medium estimate) occurring between 1960 and 1965, by 1964 family income, birth order, and race. The values in parentheses are numbers of births.*

Income (dollars)	Total	White	Negro	Birth order for total				
				1	2	3	4	5+
Less than 3,000	34 (436)	27 (178)	42 (244)	10 (95)	14 (79)	38 (62)	42 (48)	57 (152)
3,000-4,999	24 (1,032)	18 (562)	39 (446)	7 (282)	12 (224)	23 (170)	30 (122)	56 (234)
5,000-6,999	16 (1,289)	14 (977)	30 (298)	3 (358)	6 (335)	22 (248)	30 (144)	44 (204)
7,000-9,999	16 (867)	16 (772)	28 (84)	4 (214)	4 (226)	20 (174)	29 (121)	42 (132)
10,000 and over	15 (561)	15 (541)	16 (19)	3 (123)	9 (143)	14 (120)	26 (88)	34 (87)

* See footnote to Table 1.

Table 4. Percentages of unwanted births (medium estimate) occurring between 1960 and 1965, by poverty status, race, and birth order. The values in parentheses are numbers of births.*

Poverty status	Total	White	Negro	Birth order for total					
				1	2	3	4	5	6+
Poor and near-poor	32	25	46	7	14	28	34	46	56
Poor	37 (861)	31 (346)	47 (494)	9 (135)	16 (179)	30 (213)	35 (186)	47 (178)	61 (337)
Near-poor	23 (424)	16 (253)	40 (170)	5 (137)	10 (151)	22 (130)	32 (77)	43 (63)	42 (120)
Non-poor	15 (2,979)	15 (2,492)	22 (444)	4 (1,674)	6 (1,481)	20 (1,061)	28 (670)	42 (308)	42 (320)

* See footnote to Table 1.

Table 5. Estimated numbers (in thousands) of unwanted births in the United States between 1960 and 1965,* by birth order, race, and poverty status.

Race	All birth orders	Poor and near-poor	Non-poor	Birth order for total					
				1	2	3	4	5	6+
1) <i>Unwanted by both spouses</i>									
Total	4,050	1,738	2,312	261	369	831	742	669	1,178
White	2,828	838	1,990	176	236	677	576	499	664
Negro	1,103	836	267	82	116	126	151	157	471
2) <i>Unwanted by at least one spouse</i>									
Total	5,321	2,214	3,107	376	553	1,102	1,031	841	1,418
White	3,736	1,062	2,674	234	375	879	800	632	816
Negro	1,432	1,067	365	132	163	193	206	186	552
3) <i>Medium estimate, average of categories 1 and 2</i>									
Total	4,685	1,976	2,709	319	461	966	886	755	1,298
White	3,282	950	2,332	205	306	778	688	566	740
Negro	1,267	951	316	107	139	159	178	172	512

* Proportions of unwanted births in the NFS sample are applied to vital statistics data for the United States (see Appendix for technical details). In the absence of official data on births by poverty status, we have estimated the number of unwanted births to the poor and near-poor on the basis of the distribution by poverty status of unwanted births in the NFS sample.

ing failures. A birth was classified as a timing failure when it was reported as wanted but not the result of the deliberate interruption of contraception.

Of wanted births occurring between 1960 and 1965, two-fifths would have occurred later if their timing had been controlled. The short-run demographic effects of the prevention of timing failures depend upon the length of time considered and the assumed time required for the transition to perfect contraception (contraception enabling every couple to avoid failures in regulating family size and in timing births). For example, if perfect contraception had been universally employed at the beginning of 1960, perhaps 7 percent of the wanted births that occurred between 1960 and 1965 would have been delayed until after 1965. This estimate is based on the assumption that the average length of a successfully planned interval is 1 year longer than that of an interval in which timing was not controlled. If births are delayed, total fertility for each cohort (women born in the same year) being kept constant, there is a dip in births while the change occurs and no subsequent "makeup" of the lost births until the mean age of childbearing falls. When the transition is complete, a certain number of births will have been deferred to subsequent

years, and this number will remain fixed so long as the new spacing pattern persists.

After the transitory dip is over, the number of births may be affected by increased spacing (total fertility for each cohort being kept constant) because fertility is centered on a lower portion of the stable age distribution. This effect is negligible in a low-mortality population reproducing at a rate near replacement.

There is, however, one possible indirect consequence of such timing changes that has potential long-run significance. It has been suggested that the longer a birth is delayed, the less likely a woman is to have that birth or a subsequent birth (10). The longer a couple puts off having a "wanted" child, the more opportunity the wife has to acquire role patterns at variance with early child-care responsibility. At some point that birth, or a desired subsequent birth, may no longer seem so desirable. In addition, the delay of a desired birth increases the possibility that the birth will be prevented by subfecundity. In any event, the major demographic effect of the universal use of contraception would be the prevention of unwanted births. In the next section we will discuss the long-run implications of this effect.

Long-Run Implications for U.S. Growth Rate

Since nearly 20 percent of all recent births were unwanted, the elimination of unwanted births could substantially reduce our future growth rate. However, the size of this reduction would depend upon the number of children that women now entering the childbearing years will ultimately want to have.

Viewed from a cohort perspective, for women who were near the end of their childbearing years in 1965 (ages 35 to 44), the elimination of births reported to have been unwanted would have reduced their fertility from 3.0 to 2.5 births per woman. Since an eventual zero rate of population growth would require cohort fertility of about 2.25 births per woman, the elimination of unwanted births would not have been sufficient to establish exact replacement for this cohort, but it would have resulted in considerable progress toward that objective. The proportion of unwanted births (16 percent) reported by this cohort—the figure used to calculate the above estimate of 2.5 births—is lower than the proportion reported for all women in the period 1960–1965, probably due to additional underreporting of unwanted births resulting from the longer period of time that had elapsed since the events in question in the case of the women aged 35 to 44. The demographic effect of eliminating unwanted births is probably greater than we infer because of this underreporting by older women and the probable underreporting of unwanted births in general, and also because the additional children born to these older women before they reach menopause will undoubtedly be mostly unwanted.

The above estimate is based on the experience of married women whose childbearing took place in the high fertility period of the early 1950's. Under circumstances of perfect contraception, women now entering the childbearing years might decide to have larger families than women who have preceded them would have had if they had complete control of fertility, but this does not seem likely. Rapid diffusion of use of the pill has continued since 1965, and one of the consequences of this diffusion may be reduction of the number of "desired" as well as of unwanted children. As women are able increasingly to postpone pregnancy and to enter into nonfamilial roles (particularly employment), many may prefer to have

Table 6. Percentages of wanted births classified as timing failures,* by birth order and race. The values in parentheses are numbers of births.†

Race	All birth orders	Birth order					
		1	2	3	4	5	6+
Total	43 (3,217)	38 (1,020)	42 (906)	50 (587)	50 (335)	44 (162)	47 (207)
White	42 (2,513)	36 (805)	40 (722)	48 (466)	48 (269)	42 (116)	46 (135)
Negro	56 (657)	50 (199)	61 (174)	59 (114)	62 (64)	57 (42)	50 (64)

* A birth was classified as a timing failure when reported as wanted but not the result of deliberate interruption of contraception. † See footnote to Table 1.

smaller families than they would otherwise have chosen. If, in addition, there is a trend toward nonfamilial female roles, there may be strong pressures against any upsurge in the average family size that would be achieved by American women with complete fertility control.

In fact there are already indications that the ultimate family size of the most recent cohorts may be lower than that of preceding cohorts (11). This decline may be the result of some reduction in unwanted births, in some reduction in the number of children women want to have, or in some combination of these factors. Predicting the fertility of young women is always precarious, but it seems likely to us that, under the assumption of perfect contraception, the ultimate number of children today's young women would bear would be below the number inferred, under the same assumption, for women who were between the ages of 35 and 44 in 1965. There is some evidence from longitudinal studies that success in the control of fertility results in smaller families than were originally desired (12).

However, it is very important that we keep in mind the legacy of past fertility when considering the potential implications, for the U.S. growth rate, of the elimination of unwanted births. Even if exact cohort replacement could be achieved, the population would not immediately cease to grow. The time required for cohort fertility to reach the replacement rate would depend upon the speed with which universal perfect contraception was achieved. After the replacement rate had been attained, it would be some time before the effects of past fertility on the age structure would level off. Frejka has prepared estimates directly relevant to this question (13). He demonstrates that if the cohort comprised of women entering their childbearing years between 1965 and 1970 and all subsequent cohorts were to achieve a cohort fertility of exact replacement, the population would continue to grow at least until the year 2035, with a resultant increase in size of 40 to 50 percent.

In summary, the elimination of unwanted births would lead to a reduced growth rate for the United States, barring a marked increase in the average number of children desired. However, even if cohort replacement were achieved (perhaps as a consequence of other developments as well), a zero growth rate for the United States could

not be achieved for over 60 years, by which time the population would number over 280 million. The longer it takes to achieve universal perfect contraception, the longer it will take to reduce our growth rate, and the larger, of course, will be the eventual size of our population.

In terms of the implications for a population policy goal of zero growth, our findings do not imply that the task of influencing people to want fewer children should be ignored, especially since this number could shift upward again. However, the elimination of unwanted births would have considerable demographic effect, it would be desirable in human terms, and it would probably be a more readily attainable objective.

Appendix: Comparison with Other Measures

Since the conclusions reached by the use of more conventional measures of "desired" or "ideal" family size (14) differ radically from those reached by our procedure of inferring the desired number of children, a word on the differences in the two approaches is necessary. The first is used typically in surveys with married women of all ages within the reproductive span and with varying numbers of children; in this approach the woman is simply asked how many children she would like to have or how many she would consider ideal for herself, or, in some instances, for the average American family. Our approach has been to infer the desired number of children by subtracting the number of unwanted births from the total number of births. The latter procedure results in considerably lower estimates of the number desired. For example, married women aged 35 to 44 in 1965 reported, through the direct approach, a "desired family size" of 3.4 children, as compared with 2.5 children as estimated by our procedure.

In general, the difference is probably attributable to real differences reflected by the two types of measurement. In the direct approach, desired family size relates to the time of the survey and is based on the respondent's fertility history and on her and her husband's adjustment to it. It is not at all inconsistent for a couple that has had a child that had been unwanted to state later, on the basis of a satisfactory (even beneficial) adjustment to the unwanted

birth, that the size of their family is what they desire. To infer that this is the number of children such couples would have wanted under the conditions of perfect fertility control would be erroneous. For couples early in their life cycle, the measure of "desired family size" may be highly invalid as a predictor of the number of children they would have if they could control their fertility. The average family size desired by young couples corresponds closely with the eventual average family size for these couples, regardless of the number of unwanted births; this suggests that the number of children young couples desire before the experience of childrearing may be largely a reflection of the observed sizes of the families of other couples of similar social status.

On the other hand, when desired family size is measured by subtracting (for women past the childbearing years) the number of unwanted births from the number of children borne, the time focus is on evaluation of the event at the time of pregnancy. Although the responses may still be influenced by intervening experience, this bias should be much less than the bias when the reference is to the present, or to the future conditioned by the present.

The two types of variables can be measured independently, since about half of the women who reported an unwanted birth also said they would not have preferred to have fewer children than they had. Both measures are useful, but it seems to us that the approach we have defined in this article is the more suited to the task of assessing the demographic implications of perfect contraception.

References and Notes

1. J. Blake, *Science* 164, 522 (1969); O. Harkavy, F. S. Jaffe, S. Wishik, *ibid.* 165, 367 (1969).
2. C. F. Westoff and N. B. Ryder, in *Fertility and Family Planning: A World View*, S. J. Behrman, L. Corsa, R. Freedman, Eds. (Univ. of Michigan Press, Ann Arbor, 1969), p. 394.
3. For a description of this sample see N. B. Ryder and C. F. Westoff, *Science* 153, 1199 (1966). A high level of unwanted fertility in the United States has been reported on the basis of national fertility studies; in this article we draw attention to the implications of the current patterns of unwanted births. For the earlier reports see R. Freedman, P. K. Whelpton, A. A. Campbell, *Family Planning, Sterility and Population Growth* (McGraw-Hill, New York, 1959), pp. 100-153; P. K. Whelpton, A. A. Campbell, J. E. Patterson, *Fertility and Family Planning in the U.S.* (Princeton Univ. Press, Princeton, N.J., 1966), pp. 221-275, 361-370; N. B. Ryder and C. F. Westoff, *Demography* 6, 435 (1969).
4. N. B. Ryder and C. F. Westoff, *Reproduction in the United States: 1965* (Princeton Univ. Press, Princeton, N.J., in press), chap. 14, table 5.
5. Ryder notes that these levels of unwanted fertility are consistent with a regulatory pro-

- cedure that is 99 percent perfect. See N. B. Ryder, "The time series of fertility in the United States," paper presented before the International Union for the Scientific Study of Population, London, 1969.
6. R. G. Potter and J. M. Sakoda, *Demography* 3, 450 (1966).
 7. M. Orshansky, *Soc. Secur. Bull.* (March 1968).
 8. These estimates of the percentages of unwanted births among poor and non-poor, and the estimates of the gross number of unwanted births in the period 1960 to 1965, discussed in the next section, are of the same order of magnitude as values presented in a

- preliminary approximation by F. S. Jaffe and A. F. Guttmacher, *Demography* 5, 910 (1968).
9. Our sample design for a new national study in 1970 which calls for a sample of "ever married" women will provide a better basis for making these estimates.
 10. R. Freedman, L. C. Coombs, L. Bumpass, *Demography* 2, 267 (1965).
 11. N. B. Ryder, in *Fertility and Family Planning: A World View*, S. J. Behrman, L. Corsa, R. Freedman, Eds. (Univ. of Michigan Press, Ann Arbor, 1969), pp. 99-123.
 12. C. F. Westoff, E. G. Mishler, E. L. Kelly, *Amer. J. Sociol.* 62, 494 (1957). Additional

- evidence pointing to the same hypothesis appears in the Princeton Fertility Study (unpublished tabulations).
13. T. Frejka, *Population Stud.* 22, 394 (1968).
 14. For discussion of the relationships between these variables see N. B. Ryder and C. F. Westoff, *Population Res.* (March 1969) and A. A. Campbell, *Fam. Planning Perspect.* 1, No. 2, 33 (1969).
 15. We thank Ansley J. Coale, Ronald Freedman, Fred Jaffe, Suzanne Keller, and Norman B. Ryder for critical appraisals of the manuscript. We also acknowledge the able computer programming assistance of Andrea Smith.

NEWS AND COMMENT

Science Service: Publishing Pioneer in Financial Trouble

Science Service, Inc., a half-century-old publishing organization that pioneered in attempts to promote the public understanding of science, is in danger of financial collapse. The Washington-based nonprofit corporation, whose board includes many distinguished figures from the scientific community, has been running at a big deficit for several years now and has recently appealed to the AAAS to rescue it through a merger or some other form of assistance. If help is not forthcoming, says E. G. Sherburne, Jr., the director of Science Service, "we'll have a hard time hanging on."

Science Service is best known for its popularized weekly magazine, *Science News*, which circulates some 115,000 copies; and for its conduct of the annual Science Talent Search, sponsored by the Westinghouse Educational Foundation, which seeks to identify outstanding high school seniors. The organization's financial problems have been the subject of rumors for some years now, but confirmation that Science Service is indeed in deep trouble still comes as something of a surprise. Last May Glenn T. Seaborg, chairman of the Atomic Energy Commission and currently the president of Science Service, delivered a major tribute to the organization and gave not a hint that there were any financial problems. Seaborg's speech, which was written by Sherburne, reviewed the achievements and prospects of the organization in favorable terms. "Despite the accomplishments of the past," Seaborg's speech concluded, "the future has even greater

possibilities for expansion and new developments."

In light of the information now available, that speech might fairly be characterized as "whistling in the dark." Science Service has declined to reveal any of its financial data to this reporter—even that data which nonprofit organizations are required to submit to the Internal Revenue Service on forms that are open for public inspection—and the IRS was unable to make the records available before this article went to press. Nevertheless, Sherburne acknowledges that Science Service has run at a deficit ever since he took over in 1966. Other sources at Science Service say that the deficit has mounted into the hundreds of thousands of dollars in some recent years, but Sherburne says the deficit has recently been diminishing.

The financial strain has shown up in a number of economy moves and stop-gap measures. Last January Science Service abandoned its news and feature service for newspapers, and last summer *Science News* on two occasions skipped an issue and published biweekly in order to save money and staff. Science Service is also trying to sell for \$500,000 the four old buildings it owns in the 1700 block of N Street, NW, in Washington, D.C. According to informed observers, the organization also recently took out a bank loan to help tide it over the current troublesome period.

The problems of Science Service have been exacerbated by personnel wrangles in which two executives of the maga-

zine, *Science News*, have been let go. One was Marcia Nelson, the circulation manager, who was fired, according to Sherburne, at least partly because her job had been largely taken over by a computerized subscription service. The other was Warren Kornberg, the editor of *Science News* for the past 4 years, who seems to have been fired or to have quit after a wrangle with Sherburne over whether the notoriously underpaid staff should get raises or not.

Kornberg's ouster caused a near revolution. Some staff members say they contemplated offering their resignations en masse unless Kornberg were reinstated but that idea was dropped when Kornberg said he wouldn't come back anyway. Though neither Kornberg nor Sherburne will discuss the reasons behind their rupture, staff members say the precipitating issue was apparently Kornberg's request for raises for the staff. "Warren felt he couldn't hire good people at the salaries we offer and he couldn't keep the people we have," says one staff writer. "So Warren got fired and we ended up getting raises anyway. It was incredible."

In its heyday, Science Service was perhaps the most renowned disseminator of science news to the general public in this country. It was founded as a nonprofit corporation in 1921, largely through the impetus and financial assistance of the late E. W. Scripps, a founder of the Scripps-Howard newspaper chain, who had long been concerned about lack of public understanding of scientific achievements. The organization's director for approximately four decades was the late Watson Davis, a respected popularizer and promoter of science.

Scripps' original goal was to increase the amount of science information in newspapers, so the initial emphasis of the new organization was to develop a new press service that would disseminate science news to the media. When the press service reached its peak in the 1940's, Science Service was mailing