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quires greater skills and fewer working hands.

- It should involve group activity because individuals can be better motivated in a group, and training and education are thus facilitated.
- Its aims should be individual development and, ultimately, community development.

In addition to the core employment program, the model would include a number of supportive actions, as follows: provision of nutrition, sanitation hygiene, and education for children of employed women; training and adult education; delivery of family planning services; research concentrated on study of group psychology; and formulation of new means of rapid sociostructural changes contributing to low fertility. Of special importance is the detection of early signs of behavioral changes producing low fertility and immediate implementation of actions to support these gains.

The Egyptian program is now seeking to develop a few experimental demonstrations of this plan, to test its validity and impact in the field, complete with systematic evaluation.

Status and Prospects of Natural Family Planning

by STANLEY GILDER, WILLIAM URICCHIO, *and* PHILIP CORFMAN

This article reviews a three-day conference on Natural Family Planning held at Airlie House, Warrenton, Virginia, early this year under joint auspices of the Human Life Foundation and the National Institute of Child Health and Human Development. Dr. Gilder is former editor of the British Medical Journal; *Dr. Uricchio is chairman of the Biology Department at Carlow College, Pittsburgh; and Dr. Corfman is director of the Center for Population Research at NICHD. Drs. Urrichio and Corfman were organizers and cochairmen of the meeting.*

The Human Life Foundation was founded in 1968 with a grant from the American Catholic Bishops. It is an independent, self-governing, nonsectarian research foundation with primary interest in improving methods of family planning that are based on periodic abstinence. The Center for Population Research of NICHD, also founded in 1968, is the principal Federal agency with a comprehensive program for research and training in the population sciences.

At the conference, scientists from a variety of professional disciplines and cultures explored and evaluated contemporary methods of natural family planning, analyzed its scientific basis, its assets, liabilities, and effectiveness, and considered what new research should be carried out. The meeting began with fundamental scientific considerations and ranged to clinical application.

Subject matter at the recent conference included biological rhythms, the menstrual cycle, immature and aged gametes, prediction, detection and control of ovulation, psychology of natural family planning, and teaching of clients.

Biological Rhythms

Study of the menstrual cycle, understanding of which is a key to natural family planning, begins with a consideration of the complex biological rhythms detectable in all living organisms. These rhythms are of two kinds, as Dr. Frank A. Brown (Northwestern University) pointed out; there are the rhythms dependent on geophysical forces, and those that operate apart from the environment. These latter are known as circadian, circatidal, circamonthly, and circannual cycles, and their frequencies often depart slightly from geophysical ones as a consequence of a continuous and self-induced shifting of phases. These rhythms and their modifications appear early in embryonic life; the site of their registration in the nervous system remains unknown.

The field of inquiry was narrowed by Dr. Andrew Nalbandov (University of Illinois) who described the reproductive rhythms of mammals. In discussing estrus cycles, he pointed out that the restricted heat periods in nonprimates insure the union of gametes, male and female reproductive cells, during the prime of their life. One result apparently is infrequent occurrence of physical and mental defects in the offspring, in contrast to primates, which are sexually receptive for longer periods. Nalbandov advocated more comparative studies of reproductive rhythms of animals that are more akin to man in their endocrinology than the laboratory rat, studies of which he blames for much of the misunderstanding of the human reproductive process.

Domestic mammals are a better source of information. These mammals can be classified into two groups by type of reproductive cycle: macrocycles and microcycles. Macrocycles are exhibited by seasonally breeding animals, which show estrus cycles only at certain times of the year, an example being the autumn period of fertility in sheep. Microcycles are those of animals that breed at regular—for example, monthly—intervals, an example being the 21-day cycle of the rat.

The mechanism underlying reproductive cyclicity appears to operate via catecholamines, which stimulate the nuclei in the hypothalamus to secrete certain peptides (called releasing factors) which pass through veins to the pituitary. The hormones secreted by the pituitary then act on the ovary and testis and control reproductive functions. The gonads in turn secrete hormones that return to the hypothalamus and help regulate releasing-factor production.

It has been suggested that stress may induce ovulation at times other than the expected period, as some preliminary work has shown in the case of rape. The evidence seems to be equivocal, however, and many more data are needed. The possibility of induced ovulation is important to the successful practice of natural family planning and should be studied as well as other events in the reproductive cycle such as follicular growth, the process of ovulation, and corpus luteum formation and function.

The Menstrual Cycle

What makes the primate menstrual cycle cyclical? Within the cycle there are apparently two sets of closely integrated variables, hormonal and morphological. Dr. Raymond Vande Wiele (Columbia University) presented the outlines of a complicated series of equations from

which he and his colleagues have constructed a mathematical model that simulates the changes in the cycle. His equations attempt to express in a qualitative and quantitative manner all known hormonal changes and other variations.

From computer treatment of the data several interesting features have emerged. One is that introduction of normal random variations into the model is enough to account for the occasional occurrence of anovulation, late ovulation, and other phenomena hitherto regarded as pathological. Another is that the classical feedback model does not entirely explain the cycle. Instead of the steady rise and fall in hormone levels thought to occur, a series of rapid oscillations have been revealed. The oscillations in luteinizing hormone and estrogen levels are in phase in the first half of the cycle but out of phase in the second half. It seems that an exact picture of ovarian activity is being communicated to the hypothalamus every instant, and this communication may suggest a new basis for inducing or blocking ovulation.

Some clinicians believe their women patients when they speak of having a "regular cycle", but this is a myth according to the extensive studies of Dr. Alan Treloar (National Institutes of Health), who has accumulated over many years the menstrual histories of University of Minnesota students, their daughters, some granddaughters, and more recently, Alaskan Eskimos.

Dr. Treloar's study includes a complete analysis of the menstrual histories from commencement of the menstrual cycle (menarche) to menopause. This work has established the extreme instability of the cycle in the early years after menarche and after age 40. The period between 20 and 40 years is one of relative stability, but even then there are variations enough to expose the 28-day cycle as a myth. Every woman seems to have her own cycle period, 5 percent showing periods shorter than 24 days and another 5 percent periods longer than 37 days. Shortening of the cycle occurs as women age from 20 to 40 years, but this is not uniform, nor does an individual woman have periods of equal length. There seems to be no relation of cycle length to lunar cycles, nor have any cultural or geographic (latitudinal) differences been detected; the data from Alaska are similar to those from Minnesota.

Dr. Rudolf Vollman (National Institutes of Health) summarized data from a 37-year follow-up of a relatively nonmobile Swiss population and pointed out some pitfalls in assessing matters concerned with reproduction. One technical problem is that all his evidence for ovulation is circumstantial. Age effects on basal temperature and the length of the premenstrual phase are often disregarded. Frequency of intercourse per cycle also affects results, and the effect varies with length of menstrual period. In Dr. Vollman's series, when the day of intercourse was accurately known, no pregnancy occurred more than a day after the temperature rise and none before the ninth day of the cycle.

Immature and Aged Gametes

As pointed out by Dr. Nalbandov, in most creatures, ranging from sea urchins to mammals, fertilization takes place almost immediately after the egg has been shed, so that fresh gametes are assured. The sequence of events from ovulation onward, beautifully demonstrated by Dr. Richard Blandau's (University of Washington) films, nevertheless is subject to mistiming and subsequent abnormalities.

When an ovum is fertilized later than normal, it is called aged and subsequent abnormalities in cell division may occur. As reviewed by Dr. Blandau, electron microscopy has shown that in an aging ovum the protective layer of granules under the cell membrane, which normally appear to prevent entry of a second spermatozoon into a fertilized ovum, has moved deeper into the cytoplasm or is absent, and thus polyspermy is likely to occur. In vitro studies suggest that fertilization of aging ova is associated with a larger fraction of abnormal births than with normal ova.

Both aged and immature spermatozoa also appear to be a liability—according to the work of Dr. Marie-Claire Orgebin-Crist (Vanderbilt University). In the rabbit, fertilization with either immature or aged sperm has been shown to lead to more abnormalities in the fertilized ovum, such as abnormal numbers of chromosomes, leading to death of the fetus in most instances.

The situation in man is as yet unknown, but there is a possibility that quite subtle aging changes may lead to abnormalities. If research in experimental animals can be taken as an indication, the use of natural family planning may increase the probability of fertilization with aging gametes. Coitus some time removed from ovulation may result in an increased risk of spontaneous abortion. There are also claims of an increased rate of congenital malformations among children born to parents in regions where natural family planning has been used, such as Ireland and New England.

These claims, although few, are sufficiently alarming to warrant more research into effects of fertilization with aging human gametes. There are a number of unknowns. For example, we do not know how long human sperm or ova remain viable. Figures quoted are inspired guesses, and it is likely that although sperm can remain motile for 24–28 hours they may lose their fertilizing ability earlier. Ova may remain fertilizable for only 15 to 18 hours. Recent recordings of the interval between coitus and ovulation as determined by temperature rise suggest no relation between abnormality and time interval, but temperature rise is notoriously variable as an indicator.

There is a clear need for data on a large number of pregnancies to ascertain any adverse effect of aging sperm or aging ova, and Dr. Rodrigo Guerrero (Valle University, Cali, Colombia) listed possible research projects to deal with this problem. He would like to see large-scale studies of the probability of conception and of abortion after intercourse on any given day of the menstrual cycle. There is also need for a study of the incidence of Down's syndrome (mongolism) in relation to time of intercourse.

Ovulation Prediction, Detection, and Control

For years it has been obvious that natural family planning would be greatly improved by development of a *predictor* of impending ovulation. (A new *indicator* of present or past ovulation would not advance natural family planning technology.) To be useful, a predictor would have to be simple, cheap, painless, rapid, specific, reliable, and recognizable in most women. If a test is to be of maximal use in natural family planning, it must become positive about 72 hours before ovulation. Unfortunately we are still looking for such a sign.

Dr. John R. Marshall (University of California, Los Angeles) reviewed the many attempts made to find such predictors. Tests applied to blood specimens are of limited practical value for obvious reasons. Many papers have documented studies of hormone and steroid levels, but none has proved of practical value on a large scale. Urine tests are easier from the

patient's viewpoint, but such measurements as that of pregnanediol have the disadvantage that they are difficult to carry out and so far act only as indicators. Currently under evaluation is a test for urinary xanthurenic acid, which increases at about the time of ovulation.

Tests on saliva have been proposed, particularly a new and unproven technique for measuring alkaline phosphatase on a paper strip. Cervical mucus has been the subject of several chemical tests, none of which has been successful. Another indicator that might prove useful is the measurement of skin temperature of the breast, which undergoes vascular changes that are probably estrogen dependent.

Second only to ovulation *prediction* is ovulation *control* as a means to improve natural family planning. Because many menstrual cycles are irregular, efforts have been made to regulate ovulation by administration of a variety of steroids and hormones. Clomiphene, in particular, has received much publicity because of its association with multiple births. Discussion at the conference made clear that much work must be done if ovulation control is to become a truly useful method.

Mucus Observation

A husband and wife team from Australia are enthusiastic advocates of what they call "the Ovulation Method." Drs. John and Lyn Billings (Queen Victoria Hospital, Melbourne) have trained large numbers of women to recognize the quantity and quality of cervical mucus secreted during the cycle as an indicator of fertile and infertile days. The women simply note the dryness or moisture in the genital area. Depending on the length of the cycle a number of dry days will occur after menstruation. The dryness is followed by a gradual change to a wet or sticky sensation. As the days go on, the mucus becomes thinner, clearer, stretchy, and more copious with a sensation of slipperiness at the most fertile days of the cycle. The fourth day after the peak symptom is the start of the infertile period. Although some doctors are highly skeptical of this method, most women seem to have no difficulty with it. They experience the sequential changes in the mucus and can predict ovulation satisfactorily.

Temperature Method

Since 1946 Dr. Gerhard Doering (Stadt Krankenhaus, Munich) has been teaching the temperature method of natural family planning, and he reported reasonably satisfactory results. His figures show that if the strict technique is followed (by which intercourse is restricted to the postovulation period of the cycle) the failure rate is very low. If intercourse is also permitted immediately after menstruation, the failure rate rises from 0.8 to 3.1 pregnancies per 100 women per year. Many of these pregnancies are due to patient failure and not to failure of the technique. Dr. Doering announced that after hearing the paper by the Billingses he intended to apply the Melbourne method to women with irregular cycles.

Psychology of Natural Planning

Among the generally accepted criteria for contraceptive methods, such factors as effectiveness, safety, moral acceptability, facility in teaching, and noninterference with pleasure have been frequently included. However, as Dr. Conrad Baars (Rochester, Minnesota) pointed out, there has been relatively little concern about the mental health of the couple. Although we accept the pursuit of pleasure as a goal, should we not look to family planning as an aid to the pursuit of happiness, and as an activity that makes for mental health and does not interfere with growth and maturity?

Dr. Judith M. Bardwick (University of Michigan) commented on the almost total absence in the scientific literature of psychological studies of natural family planning and of other methods as well. She emphasized that most of the writing about contraceptives is based on rational grounds and that the important and difficult irrational element tends to be overlooked. She went on to analyze in psychological terms the virtues and drawbacks of natural family planning. On the positive side it is without cost, always available, reversible, and physiologic. On the negative side, it requires close attention to the menstrual cycle, and it is not psychologically easy for women to focus attention daily on functions they often prefer to ignore. Also, natural family planning diminishes spontaneity and is associated with anxiety. It requires abstinence, and its failure may be associated with guilt. Several speakers felt that Dr. Bardwick was incorrect in linking the method with anxiety; it had been their experience in a number of countries that women were less anxious when they had been taught more about their reproductive function and its control.

A questionnaire on the psychological aspects of natural family planning was circulated among husbands and wives who were using the temperature method in England. The results, summarized by Dr. W. Michael Moore (Manchester), on behalf of Drs. John Marshall and Beverly Rowe, showed that although most husbands and wives worried while learning the method, most had ceased to worry when they grew accustomed to the practice. A substantial minority thought that worry affected their attitude towards intercourse. Most people found abstinence difficult; about one-quarter thought it had changed their relationship for the worse, and over half were more conscious of sexual feelings during periods of abstinence. Nevertheless, three-quarters of this selected sample found the method satisfactory, and most thought it had helped their marriages.

Father Francis Madigan (Xavier University, Philippines) is mainly concerned with two questions in the Philippine setting: What impact does the practice of natural family planning have on Filipino couples and on their parent-child relations, and how do these effects differ from those when contraceptive pills or IUDs are used? Two sets of answers have been derived. The positive set stresses the satisfaction of husbands at learning to control their sex drives; the negative set stresses the difficulties involved in the necessary suppression of these urges. Relations within the family are often particularly difficult in the Philippines where there is great stress on social acceptance. There are obligations to return favors, and these obligations extend to the parent-child relationship, tending to unite families. On the other hand, grudging male acceptance of natural family planning may aggravate marital disharmony.

Dr. Mary Ella Robertson (Boston College) stressed the whole social scene. She pointed out ways in which cultural factors such as social class, economic conditions, aspiration levels, and motivation influence family size, family planning, and fertility. The general shift in society has changed people's thoughts about family size, but couples approach the planning of their families in different ways. Some lay their plans well; others are simply hopeful, and some are frankly pessimistic. Middle-class Catholics are developing better patterns of communication about family planning. Effective family planning and satisfactory sex adjustment are associated with much sharing, interchangeability of roles, and ease of communication.

Teaching of Clients

Teaching techniques vary widely for natural family planning, as for other types of contraception. Techniques must be adjusted to the consumer's level of education and to the couple's environment and accessibility. Three different approaches were described by G. C. Nabors (University of Texas, Dallas), Dr. Bernard Pisani (New York University), and Dr. John McCarthy (Family Life Center, Pittsburgh).

Dr. Nabors has clients from a wide geographic area, often without ready access to a suitable clinic. He developed a correspondence course in which women are taught from material sent each month along with a quiz to test their comprehension of previous material. Dr. Pisani operates in a city area with a shifting population, receives patients only by referral, and teaches in facilities removed from the usual clinic. Telephone consultations and correspondence are included in the program. Some 2,000 women were taught over the past ten years. Dr. McCarthy's situation is somewhat different, because his teaching is an integral part of a community family life program. Under a grant from the U.S. government he has developed a program and training aids for use with clients of limited education and income.

National experience with natural family planning in a variety of countries has shown that population programs appear to develop around effective teachers. This was a central theme emerging from a session at which Drs. Francois and Michele Guy (Grenoble, France) outlined experience with people from a variety of religions in Mauritius. Father Madigan indicated that a substantial number of Filipinos have now accepted the temperature method in a program sponsored in part by the U.S. AID program. Drs. John and Lyn Billings emphasized that successful teaching of the Ovulation Method depends on a separation of instruction from that of other methods, dedication on the part of teachers, and a woman-to-woman approach in spreading the doctrine. They were particularly insistent upon independence from reliance on temperature records.

Repeated throughout these sessions was the urgent need for careful evaluation of all programs. Several speakers made a plea for a data bank in which information from all cases might be analyzed. It was further suggested that such a bank ought to include data from Canada, Europe, and other areas where natural family planning is better organized than in the United States.

There are many problems in assessing effectiveness of any contraceptive technique, as Dr. Bernard Greenberg (University of North Carolina) pointed out. Even with recent improvements in measurement, such as the life table system, bias can be introduced by various means such as the use of a training period before results are measured, thus eliminating some high-risk women. Failures are often rationalized away. For example, it may be claimed that the woman did not understand the method, but many women who do not fail also may not understand the method properly. Or it may be claimed that the woman wanted to become pregnant; the evidence for this may be after the fact.

Conclusion

During the three days of the conference, those with experience in the field demonstrated that natural family planning is a feasible method of contraception for couples with sufficient motivation and a willingness to accept a measurable risk of pregnancy. A critical block to progress is the lack of trained personnel to teach already established techniques.

On the other hand, all participants agreed that natural family planning must be improved if a significant number of new couples, both Catholic and non-Catholic, are to use it. Improvement is dependent on further research, such as careful evaluation of classic and newly developed techniques for effectiveness and psychosocial impact. Research on the human menstrual cycle with emphasis on prediction and control of ovulation is needed if entirely new techniques are to be developed. An often repeated theme of the conference was the need for psychological and sociological studies to increase the use of natural family planning, with full recognition of its strengths and weaknesses.