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EDITORIAL

Insights into Reproduction

The process of reproduction, any proud parent will tell you, is nothing short of a miracle. Indeed, the elaborate phenomenon by which gametes fuse and develop into a new individual, sharing characteristics of both parents, is by its very nature difficult to reduce to individual components for experimental analysis and manipulation. Now, however, progress in the fields of cell biology, molecular biology, and genetics is enabling reproductive biologists to reach critical insights into the molecular mechanisms that underlie some of reproduction's fundamental events.

We have invited articles that focus on areas where substantial new information—about plants and animals—has improved our understanding of the reproductive process. In our News section for this special issue, reporters have focused on how this understanding may affect human reproduction, by enhancing prospects for healthy births on the one hand and pointing to new methods of contraception on the other.

The attachment of the mammalian embryo to the uterus (implantation) and subsequent formation of the placenta is one area in which research has produced several new insights. Cross *et al.* describe how identification of genes that regulate these processes and information on the function of various proteins—from cytokines to transcription factors—can now be combined to reveal the outlines of the mechanisms by which the embryo establishes contact with the mother and by which communication is conveyed back and forth between the embryo and its host. "Knockout mice" that lack expression of a particular gene have yielded surprises in many fields, and reproductive biology is no exception. Korach summarizes the phenotypes of estrogen receptor knockout mice and that of a human male who lacks a functional estrogen receptor. These studies emphasize the important role of estrogen in both reproductive biology and in the physiology of bone.

The sex of a mammalian embryo is essentially determined by whether or not it inherits a Y chromosome. Expression of a critical gene, SRY, on the Y chromosome is sufficient to cause the regression of the primordia of the female gonads and development of the male reproductive system. Haqq *et al.* present and discuss evidence that SRY functions as a transcription factor. Structural studies, molecular biology, and genetic analysis of patients with disorders of sexual development yield new understanding of how mutations that cause sex reversal in humans may be explained. Like mammals, unisexual plants initially develop primordia of both male and female organs. Dellaporta and Calderon-Urrea describe how sexual determination in maize is achieved by degeneration of one set of primordia and how steroid-like hormones contribute to feminization. Genes that influence these processes have been identified. Most plants, however, have both male and female organs within a single flower. Nasrallah *et al.* describe how plants, to avoid deleterious effects of inbreeding resulting from self-pollination, have developed elaborate systems of self-incompatibility.

Human reproduction, in recent years, has undergone dramatic changes, in part due to our own ability to intervene. In many of the countries of Eastern Asia, birthrates have declined rapidly, and Feeney discusses possible causes and implications of these phenomena. Declining human birthrates, however, are the exception and not the rule, and the World Health Organization has suggested that if the global population is not to exceed 6.2 billion by the year 2000, the number of contraceptive users worldwide must increase by an estimated 106 million.* Two news reports examine developments that could affect that prospect. One is progress toward effective contraceptive vaccines, which researchers agree are sorely needed improvements on existing technology. A second story examines why those existing methods—such as barriers, the birth control pill, and related technology such as Norplant implants—have been the only choices available for many years, and why pharmaceutical companies and scientists have been slow to pursue alternate approaches.

New scientific insights are also being applied to enhance reproduction, and in the case of premature births, molecular biology and physiology are pointing toward advanced warnings for premature labor that could lead to effective intervention. A news story on this topic examines how researchers are hoping to assist in keeping reproduction's miracle on course.

Joshua Fischman and L. Bryan Ray

* "Challenges in reproductive health research: Executive summary," World Health Organization, Geneva, 1994.