

Prenatal Power Plays

by David Haig

The most intimate human relationship is that between a mother and her unborn young. A fetus obtains all its nutrients and disposes of all of its wastes via its mother's blood. It shares every breath that its mother takes, every meal she eats, and draws on her fat reserves when food is scarce. What is the nature of this relationship? Do mother and fetus form one body and one flesh, a harmonious union with each attentive to the other's needs? Or is the fetus an alien intruder, a parasite that takes what it can without concern for its maternal host?

Neither the idyllic nor the parasitic vision adequately captures the complexities of pregnancy. Because they share half their genes, mother and fetus have common genetic interests, but sometimes their interests conflict because each also carries genes absent from the other. In particular, maternal and fetal genes are predicted to "disagree" over how a pregnant mother should allocate energy, time, and resources between her own needs and those of the fetus.

Mammal species vary markedly in the ability of the fetus to influence the amount of food it receives from its mother. Bush babies, for example, are small African primates with a placenta that simply absorbs uterine "milk" secreted by the glands of the mother's uterus. Other nutrients diffuse directly from the mother's blood to fetal blood across the thin layer of maternal and placental tissues that separates the two bloodstreams. A bush baby mother is probably able to control the flow of nutrients to her fetus by contracting or relaxing the blood vessels supplying the lining of her uterus. Similar arrangements occur in a variety of animals, including pigs, cows, and whales.

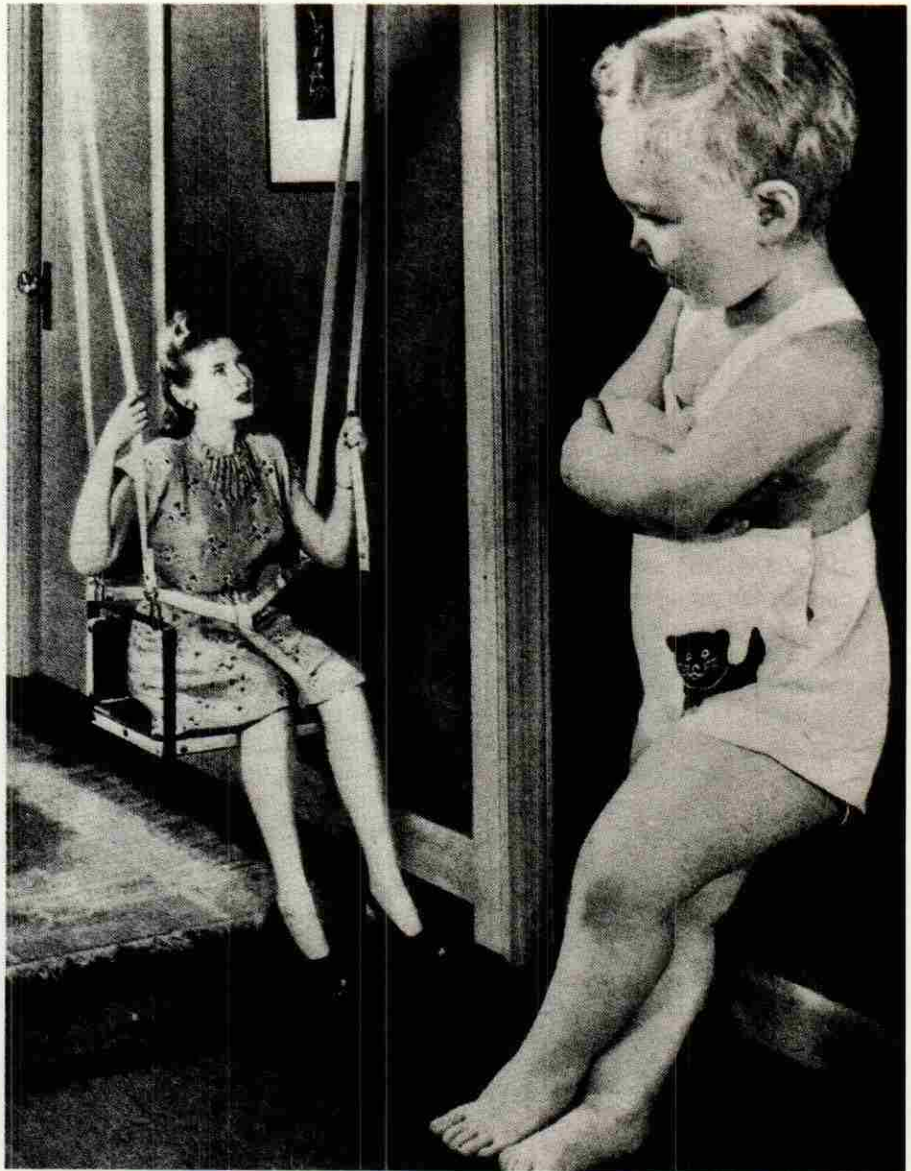
By contrast, the human placenta is invasive (as are the placentas of mice, bats, sloths, and armadillos). Uterine milk is a significant source of nutrients only during the earliest stages of pregnancy. As the embryo implants within the lining of the uterus, it sends out cells that invade the blood vessels supplying the uterine lining. These invasive cells destroy the muscular wall and greatly expand the diameter of the blood vessels. The result is that the fetus has direct access to its mother's blood, and the mother, unable to constrict the vessels, cannot regulate the flow of nutrients to the placenta without starving her own tissues.

Direct access to the mother's blood also enables the placenta to release a variety of hormones into her circulatory system. These

hormones probably evolved to manipulate maternal physiology for fetal benefit. For example, human placental lactogen is produced in larger quantities than any other human hormone. One of its effects is to make maternal tissues less sensitive to the effects of insulin. If this effect went unopposed, maternal blood sugar would rise higher after meals and would remain elevated for a longer period, allowing the fetus to take a greater share of each meal. The mother is not completely powerless, however, and responds by increasing insulin production. Mothers usually maintain control of their blood sugar during pregnancy, but when they do not, gestational diabetes develops and is relieved only with the delivery of the baby and its placenta.

An appreciation of the genetic conflicts of pregnancy may help doctors understand other medical complications of pregnancy. Sometimes the placenta has inadequate access to maternal blood. One way for the placenta to compensate is to increase the flow of blood by increasing maternal blood pressure. When accompanied by excessive protein in the mother's urine, this high blood pressure can be a symptom of a life-threatening condition called preeclampsia.

Both mother and fetus, of course, share one overriding interest: the successful outcome to pregnancy. To reach that goal, the mother-child relationship appears from the very start to be marked by negotiation and compromise, although negotiations sometimes break down.



Advertisement, 1946, reprinted in *Representations of Motherhood*, by Bassin, Honey and Kaplin. Courtesy of Yale University Press