

Why Do Women Menstruate?

Scientists seek a reason for this feminine phenomenon

By JOHN TRAVIS

Myths, taboos, and jokes concerning menstruation—the periodic shedding of the uterine lining and consequent vaginal bleeding—are legion and go back centuries. At least one female comedian, for example, has offered the whimsical thought that this phenomenon is compelling evidence that God is indeed a man.

Ancient philosophers thought menstrual blood was the source of new life: Aristotle speculated that it harbors a substance, the *materia prima*, that a man's sperm shapes into an embryo. This theory persisted for almost 2,000 years, but it certainly hasn't been the only false belief about menstruation. Hippocrates argued that men cleanse their blood by sweating but that women menstruate to remove impurities. Another theory held that women generate more blood than they can handle and that menstruation allows them to expel the excess.

Menstruation has also often been used to cast women in a threatening light. Parts of the Bible contend that menstruating women are polluted and dangerous to men. The Roman historian Pliny wrote that menstruating women cause wine to sour, vines to wither, grass to die, and fruit to fall. As recently as 1974, *LANCET* published a letter speculating why flowers wilt if held by menstruating women.

Menstrual taboos, usually based on the notion that menstruating women are unclean, persist in many societies. Prohibition of sex during menstruation is common, and in some cultures menstruating wives aren't allowed to cook meals for their husbands. At one time, the Catholic Church didn't allow menstruating women to receive communion. Among the Dogon people of West Africa, menstruating women must sleep in special huts.

Even in the United States today, menstruation essentially remains a taboo topic. "It's a conversation-ender," says Harry Finley, who several years ago founded the Museum of Menstruation in New Carrollton, Md., in part to demystify the phenomenon.

In truth, there are few mysteries left about menstruation. The details of how it happens are well understood. Perhaps the one puzzle that remains is menstruation's biological significance. Just why do women menstruate? In the last few years, a debate has erupted over that fundamental question.

To many biologists and physicians, a sufficient explanation for menstruation is that it marks a women's failure to become pregnant during her reproductive cycle. They would argue that if an ovulated egg is not fertilized and implanted in the uterine lining, or endometrium, a woman simply sheds the complex tissue that has readied itself to nourish an embryo and starts building it anew.

Yet some scientists press the issue further and seek an evolutionary explanation for menstruation. To these biologists, bodily features or phenomena necessarily serve a functional role. According to the Darwinian idea of natural selection, they wouldn't have persisted if they didn't offer an advantage.

Fever, for example, has been dismissed as a mere side effect of an infection. Yet evolutionary biologists have suggested that fevers may instead represent an integral part of the body's attempt to eliminate the infection.

Can menstruation be subjected to a similar analysis? "My assumption is that if menstruation wasn't advantageous, there are ways over long periods of time, in large populations, for natural selection to abolish it. And since it's still there, our job as good evolutionary biologists is to figure out what are the advantages maintaining it," says Kim Hill of the University of New

Mexico in Albuquerque.

Of the serious attempts to explain menstruation from this perspective, the first that gained widespread scientific and public recognition was made several years ago by Margie Profet, a self-taught evolutionary biologist who has a history of arguing controversial theories.

Profet, who lacks a Ph.D. but won a so-called genius grant from the MacArthur Foundation in 1993, reverses the historical perception that menstruating women are unclean by proposing that the phenomenon defends women from pathogens in the vagina or cervix that invade the uterus by hitchhiking a ride on sperm.

She contends that the vaginal bleeding typical of human menstruation flushes out myriad dangerous microorganisms that could otherwise cause infertility, illness, or even death.

This protection, says Profet, more than offsets the nontrivial loss of iron and other nutrients that results from menstrual bleeding.

Based on this supposition, Profet also argues that all mammals probably experience menstrual bleeding, although the blood loss may be less obvious than it is in women. Her assertion counters the conventional wisdom that only humans, higher apes, and a few other mammals menstruate.

Profet's theory, described in the September 1993 *QUARTERLY REVIEW OF BIOLOGY*, quickly drew a barrage of criticism. Scientists, for example, noted that blood actually serves as an excellent growth medium for microorganisms and that many reproductive tract infections, such as chlamydia and gonorrhea, occur more frequently after a woman menstruates.

Profet retorts that evolutionary adaptations are rarely perfect and that some microorganisms themselves may have evolved to beat any menstrual protection. "We don't always win," says Profet, pointing out that the prevalence of AIDS, tuberculosis, and cholera isn't proof that the immune system didn't evolve to fight pathogens.

Beverly I. Strassmann, an anthropologist at the University of Michigan in Ann Arbor who has studied menstruation among the Dogon for many years, has subjected Profet's antipathogen proposal to a critique by reviewing the scientific literature. Last summer, in the June 1996 *QUARTERLY REVIEW OF BIOLOGY*, Strassmann published her analysis of Profet's hypothesis.

"There are just so many logical arguments against what she said. To the extent you can generate predictions [from her theory], none were supported," says Strassmann.

Profet's hypothesis, for example, predicts that the promiscuity of a species correlates with its degree of menstrual bleeding. Strassmann contends that the published research does not back up that notion. Several primate species that are not promiscuous have developed copious menstrual bleeding.

Strassmann further notes that women menstruate every few weeks at most, making it a seemingly inefficient means of infection control. Indeed, most women throughout evolution spent much of their adult lives pregnant or breast-feeding, which means they might have menstruated a mere 100 or so times.

"Assuming that menstruation was a rare event in ancestral populations, then it is doubtful that it evolved as a defense against pathogens," Strassmann writes in an upcoming issue of *EVOLUTIONARY ANTHROPOLOGY*.

How does Profet respond to Strassmann's critique? Profet notes that she has read only an early draft of Strassmann's *QUARTERLY REVIEW OF BIOLOGY* article and therefore believes it is inappropriate to express publicly her specific criticisms of Strassmann's work.

Still, Profet does say she finds Strassmann's arguments flawed and unpersuasive. Moreover, based upon her reading of the draft article, Profet says she has no plans to read the final published version of the paper or to respond to it. "I consider it a waste of time," says Profet, who recently left the field of evolutionary biology to study physics and astronomy.

While Profet remains resolute in her beliefs, Strassmann's critique confirmed the opinion of

many skeptics and even proved persuasive to at least one early champion of Profet's theory. George C. Williams, an editor of the journal that published both theories, was a strong supporter of Profet's hypothesis but has since changed his mind. "I think Beverly did a pretty conclusive job of demolishing the main idea of Margie's paper," says Williams.

Strassmann has also offered her own evolutionary explanation for menstruation. The anthropologist contends that Profet, and many others who discuss menstruation, incorrectly consider the phenomenon solely in terms of vaginal bleeding.

Strassmann suggests that the defining element of menstruation is the cyclical growth and regression of the endometrium. Any bleeding is simply a side effect for a small number of animals, including humans. "It's important to distinguish between arguments that explain endometrial regression and those that explain menstrual bleeding," says Strassmann.

Strassmann poses the evolutionary issue of menstruation in this form: Why do women regularly grow and shed their endometrium rather than constantly keeping the tissue ready for implantation by an embryo?

Strassmann's answer is that maintaining the endometrium would be a waste of energy. "It costs more to do that than to simply build it up when it's needed," she says. "Tissues require constant nutrients and a support system. There are lots of examples of other tissues that regress to save energy and get built up in response to a particular need."

In fact, from lizards to humans, reproductive tissues regress when not needed, says Strassmann.

To what extent might endometrial regression save energy? That's a difficult question. While a woman's menstrual cycle advances toward ovulation, the endometrial lining increases significantly in mass as the uterine tissue develops the vasculature and secretory glands needed to sustain an implanted embryo.

"Around ovulation and implantation, it consumes a lot more energy than in the regressed state," says Strassmann, citing one study which found that the endometrium's oxygen consumption, a measure of its energy expenditure, increases seven-fold from the beginning to the end of the menstrual cycle.

Indeed, the rising energy demands of the endometrium parallel the metabolic changes that occur in the body as a woman progresses through her reproductive cycle toward ovulation. Several studies estimate that a woman's metabolic rate can increase by at least 7 percent.

"It's not just the endometrium that's involved," observes Strassmann, who has calculated that if a woman could eliminate this extra energy demand for a year, she would save the energy equivalent of half a month's food. The part of that energy savings that would result from endometrial regression alone is anybody's guess, though it's likely to be very small, admits Strassmann.

Although Strassmann's explanation of menstruation has received a more positive reaction than Profet's, some scientists stress that it is far from the final word on the subject.

"My first reaction is that it's hard to believe the energy saving is significant. And I think that's lots of people's first reaction," says Hill. Yet Hill is unwilling to dismiss Strassmann's proposal, noting that even a small energy saving might have helped women during prehistoric times, when they had to scramble desperately for enough food to stay alive.

Peter T. Ellison, an anthropologist at Harvard University, admires Strassmann's critique of Profet's theory, but he doesn't believe the Michigan anthropologist has offered a compelling counterproposal.

Ellison contends that a cascade of requirements makes menstruation almost inevitable for women. He argues that in humans and other higher primates, embryos implant into the endometrium in an unusually invasive manner in order to meet the oxygen and glucose demands of their energy-hungry brains. In turn, the endometrium is forced to prepare itself for this implantation by "terminally differentiating" its cells.

This, says Ellison, means that the endometrial cells are committed to their fates before an embryo arrives and that they have a limited life span. That's why there's only a day or two dur-

ing which embryos can successfully implant, he says. "The endometrium isn't good after that. You can't save it for later," contends Ellison. Consequently, women shed the outdated lining via menstruation each time they do not become pregnant.

Colin A. Finn, a researcher at the University of Liverpool Veterinary Field Station in Neston, England, independently offers a similar line of reasoning in an article on menstruation's evolution that appears in the December 1996 *EUROPEAN JOURNAL OF OBSTETRICS AND GYNECOLOGY AND REPRODUCTIVE BIOLOGY*.

Strassmann responds that the arguments of Ellison and Finn seem flawed. She says that anatomists have established that the cycle of endometrial growth and regression is found in all mammals, even those that lack invasive implantation.

The debate over menstruation is certainly far from over. Perhaps the key point about this academic dispute, however, is that it is occurring at all.

Hill says, "I think the most important contribution Margie Profet made, which will stand regardless of the utility of her idea, is bringing to light really clearly that we have to start thinking about the functional significance of things. We can't just take something like menstruation as a given." □