Women's skills linked to estrogen levels

In the unisex '60s, you couldn't tell them apart. In the feminist '70s, you couldn't get them together. Now, in the sexually rational '80s, men and women, it seems, trust only scientists to settle once and for all what makes men men and women women.

Last week, in what some say is but scientific verification of common knowledge, two researchers reported the first documented proof that adult women excel at specific skills — and tend to do worse at others — during certain phases of their menstrual cycles. This research also confirms previous evidence that women are simply better than men at certain things — and vice versa.

The researchers back up with scientific rigor what until now was accumulated anecdotal evidence: that a woman's monthly ebb and flow of gender-related biochemicals has predictable cognitive and behavioral effects. The results were not related to mood changes and have nothing to do with premenstrual syndrome, they say.

Doreen Kimura and Elizabeth Hampson of the University of Western Ontario in London, Canada, found that when a woman experiences low estrogen levels — during and immediately after menstruation — she excels at tasks involving spatial relationships but performs poorly at complex motor tasks, including some involving speech.

In contrast, peak estrogen levels are associated with improved performance of motor and verbal tasks but difficulty with problems involving spatial relations. Peak estrogen levels occur briefly just before ovulation and again in the last 7 to 10 days before menstruation.

"This is the first demonstration of a reciprocal change in some functions at given levels of sex hormones," Kimura says. "My guess is that this also happens in males."

She and other researchers plan similar studies on men, she said in Toronto at the annual meeting of the Society for Neuroscience. In addition to other, less-documented male hormonal cycles, men's testosterone levels rise and fall every 24 hours.

The new research advances a long history of scientific inquiry into the neurological and behavioral effects of sex hormones on the brain. Animal studies confirm that the relative concentration of male or female hormones *in utero* significantly alters the neuronal organization of the fetus' developing brain. Apparently these differences in structure affect the brain's response to those hormones later in life. But in part because researchers have until now failed to look at the most relevant behavioral variables, Kimura says, documenting these effects in adult humans has proved difficult. The new research "supports the idea that male-female differences in cognitive patterns in humans are originally organized — and are still mediated by — sex hormones," she says.

Kimura and Hampson had more than 150 women perform a variety of tests designed to measure cognitive and motor skills at different phases of their cycles. Among the tests for spatial skills, for example, they asked women to predict the three-dimensional shape of a box after being shown an oddly shaped, unfolded flat piece of cardboard. Another test showed them a three-dimensional structure and asked them to predict what it would look like from a different angle, forcing the women to "rotate" the figure mentally. Still another asked the women to recognize a familiar shape embedded in a field of other shapes — a skill Kimura says may be equivalent to finding one's own car in a large, full parking lot.

While the women did better at these tasks when at low estrogen levels, the researchers confirmed previous evidence that most women — even at their best — perform spatial tasks less well than do most men at their worst.

Tests for fine motor skills and speech articulation — skills that most women, even at their worst, perform better than most men at their best — included some that required the women to repeat complicated hand and wrist movements, and some that tested their ability to repeat tongue twisters. When asked to recite five times without errors, "A box of mixed biscuits in a biscuit mixer," women at their peak estrogen levels cut 3 seconds off their average 17-second time. "That [difference] is not trivial," Kimura says. She adds that many women say they are clumsy during low-estrogen parts of the month, and "clumsy is a very gross term for having reduced motor skills."

Any of several mechanisms may account for the behavioral and cognitive effects of estrogen levels, which seem to account not only for women's monthly fluctuations in skill levels but also for some of the documented differences in skills between men and women, Kimura says. Recent research suggests, for example, that estrogen generally enhances the function of the brain's left hemisphere; it also may preferentially activate the frontal portions of the brain. Thus fundamental differences in male and female brain circuitry, which are in part determined by prenatal sex-hormone levels, might explain the relationship between estrogen levels and the ability to perform skills controlled by those parts of the brain.

Alternatively, sex hormones in adults may influence the release of specific neurotransmitters in the brain — such as dopamine, which plays a role in motor coordination.

Whatever the mechanism, says Bruce McEwen, a sex-hormone researcher at Rockefeller University in New York City, the new findings are "very significant." He and others emphasize, however, that there are dangers in overgeneralizing the findings because individual women — and men — vary in their areas of expertise and in their responses to hormones.

"Certainly there are gender differences on the average," says Estelle Ramey, professor emeritus at Georgetown University in Washington, D.C., a pioneer in the study of how sex hormones influence behavior. "The differences make it possible for the species to survive, among other things. If you take large groups of females and large groups of males and test them on a variety of traits, you'll find some [traits] that are socially induced and some biological."

But while biological differences can be significant, she says, they often fade under the bright light of societal bias. Noting the finding that women have an advantage over men in verbal skills, she chides: "So what do [men] say about women? That they talk too much. Even when you have the advantage, you can't win." Such biases are engendered by women as well, she adds. "Females also have the advantage in digital dexterity. So do they become neurosurgeons? No, they do needlepoint! In other words, the biology is just the barest beginning."

Kimura, too, warns against drawing broad conclusions from her research findings. "You don't have to look at a person's genitals to see if they are going to be a good air traffic controller," she says. "You just give them a test on spatial relations."

Nevertheless, she adds, "it's not a ridiculous suggestion" that women may want to schedule such tests — or other activities such as college entrance exams — at particular times of the month to enhance their scores. She notes that women taking birth control pills are already boosting their estrogen levels, as are postmenopausal women on estrogen replacement therapy. In contrast, some women with endometriosis, a uterine disease, take medications that lower estrogen levels. But the fact that certain traits apparently can be enhanced only at the expense of others probably makes such hormonal manipulations inadvisable for anything other than medical reasons, she suggests.

Finally, Kimura and others warn, there is little basis for assuming that women's behavior fluctuates more than men's just because women's cycles may be more biologically apparent. "There are cycles in the male, also," Ramey says, citing several studies of male behavioral periodicity. "Everything cycles that is living. Onions cycle, potatoes cycle, rats cycle. And men fall into that category also." — *R. Weiss*