

Personality and the X chromosome

Abnormalities in sex chromosome number have been associated not only with anatomical, physiological and intellectual characteristics (SN: 6/7/86, p. 358) but also with different personality traits. Psychologists now report a reassessment of some of those traits and an examination of how they arise during childhood and adolescence.

Women lacking a second X chromosome (XO) a condition known as Turner's syndrome, have been described as emotionally immature, stolid and highly tolerant of stress. Elizabeth McCauley of the University of Washington in Seattle says that in her clinical work she became concerned that there were more subtle behavioral concerns that were not being properly addressed. In a study of 30 XO adults she found markedly low self-esteem, both on a self-concept test and when the women were evaluated in an interview.

Next she examined 17 XO girls matched by a variety of factors to chromosomally normal, but short, girls. (Girls and women with Turner's syndrome tend to be very short.) McCauley reports that the XO girls were less socially adept and less self-confident. In addition, the XO children performed more poorly on a test in which they were asked whether videotaped facial expressions were intended to encourage or discourage the approach of an observer. McCauley suggests that this difficulty could contribute to the social problems. She speculates that both the spatial and face-interpreting skills may be related to the activity of the right brain hemisphere, which some scientists believe is suppressed in Turner's syndrome. She concludes, "The present findings suggest that short stature is not the reason for the social and emotional difficulties of the Turner syndrome patients."

Both men and women who have an extra X chromosome (XXY and XXX individuals) have been characterized as passive and shy. In his studies on XXY males, Charles Netley of the Hospital for Sick Children in Toronto suggests that this social withdrawal, as well as language difficulties, correlates with increased right hemisphere activity.

A study by Bruce G. Bender and Arthur Robinson of Denver's National Jewish Center for Immunology and Respiratory Medicine links childhood developmental disorders with later emotional and behavioral problems. Adolescents with sex chromosome abnormalities (SCA), who have been studied since infancy by the researchers, were evaluated for "adolescent psychosocial impairment" as defined by the American Psychiatric Association. Among the young women, there was a statistically significant difference in the proportion judged to require psychiatric treatment. Among the SCA females (XO and XXX) that proportion was more than 60 percent, compared with about 10 percent in the control group.

Bender finds that the children with neurocognitive deficits — language, motor and learning problems — tend to become the adolescents with psychosocial impairment. Most of these "high-risk" children have language deficits measurable by age 4. But about 40 percent of the SCA subjects have neither the three childhood deficits nor the psychosocial impairment.

While the scientists cannot fully explain why some children are affected by a chromosomal abnormality more than others, Bender believes the social environment plays an important role. He reports that the "high-risk" children tend to come from families ranked high in stress factors, low in parenting skills and low in socioeconomic status. "Family support, language therapy, special education and individual counseling . . . may ameliorate some of the risks of SCA," he speculates. "Our findings have shown that the detection of sex chromosome abnormalities . . . should alert doctors and parents to the possibility that the child will need extra help throughout childhood and adolescence."

The look of music

Spearmint is a cool column, so smooth it must be glass. Lemon pricks face, arms and hands with sharply pointed spears. Taste has shape, sound has color.

Synesthetes are people with a brain condition that leads to a hallucinatory welding of senses. And the poetry of their perceptions, neurologist Richard Cytowic suggests, may be a matter of relating to the world in an evolutionarily older manner.

Synesthesia has been described for centuries, says Cytowic, who has a private practice in Washington, D.C., but because there was neither technology nor vocabulary in neurophysiology for an understanding of the phenomenon, it was chalked up as a psychological quirk. However, it is "brain-based, not mind-based," Cytowic says.

Cytowic measured the blood flow, simultaneously, to various regions of the brain. Among synesthetes, he found that, compared with controls, flow throughout the brain was reduced during sensory stimulation; the greatest reduction was in the blood going to the cortex, where sensory sensations are normally processed. According to Cytowic, the tests show that during synesthesia, "the cortex is going on the back burner . . . everything is turned down."

Cytowic also studied the effect of context on stimulus perception — whether, for instance, changing the musical context of a note in relation to other notes would change its perceived color. He found that context was relatively unimportant, indicating that the senses are linked "neither at the lowest level [of stimulus processing and response], like a knee jerk, nor at the highest level," where imaginative or metaphoric connections might be made. The limbic region, an evolutionarily older part of the brain where neurons from all senses converge, is the most likely site of the sensory mixing, Cytowic says.

The limbic system in humans is very similar to that in more primitive mammals, which have a less elaborate cortex. Synesthetes are "living cognitive fossils," Cytowic says. "They have a more fundamentally mammalian way of perceiving."

Magnesium: A pregnancy problem?

Pre-eclampsia is a pregnancy syndrome that can lead to convulsions in the mother and low birthweight in the child. It occurs in 5 percent of all pregnancies in the United States, and its cause is unknown. Though injections of magnesium sulfate are given to severely pre-eclamptic women to prevent convulsions, Kenneth Weaver of East Tennessee State University in Johnson City says not enough attention has been paid to magnesium deficiency as a cause of the syndrome. "You can prevent [pre-eclampsia] by using [small] doses ahead of time," he says.

In a series of experiments, Weaver fed magnesium-deficient diets to pregnant sheep. The ewes developed hypertension and the growth of their fetuses was retarded — both symptoms of pre-eclampsia. They also had a higher rate of stillbirths.

According to Weaver, the sheep model indicates that adequate magnesium is essential to the vascular systems of fetus and mother during pregnancy, and is crucial in the placenta's ability to nourish the fetus. Laboratory studies have shown that blood vessels contract under low-magnesium conditions, and that those conditions also favor increased clotting; Weaver speculates that the magnesium deficiency increases levels of a vessel-constricting substance, thromboxane A, and decreases levels of a vessel dilator.

Most pregnant women in the Western world don't get enough magnesium in their diets, Weaver says. Because the syndrome is more damaging to the fetus than to the mother, he speculates that pre-eclampsia may actually be a protective mechanism for the magnesium-deficient mother.