Stress on the sexes: How they differ

Successful survival in any species is often dependent on the ability of organisms to respond to stress. Individuals that adapt in the face of stress survive, others do not. Evidence presented at an international symposium in New York this week suggests that women's physiological response to stressful demands is different from men's. The symposium, sponsored by the Kittay Scientific Foundation, was titled "The Psychopathology of Human Adaptation." The research on sex differences in response to stress was presented by Marianne Frankenhaeuser of the University of Stockholm.

Stress, whether pleasant, as in love, or unpleasant, as in danger, is a part of everyday life. The human body typically responds to stress by producing catecholamines (adrenaline and noradrenaline) that help to increase physical and mental alertness and efficiency. But responding to stress does not come cheaply. Too much stress, and with it the overproduction of catecholamines, can eventually lead to physical and mental exhaustion and breakdown. Ulcers, some types of heart disease and depression, for instance, have been linked to stress.

Frankenhaeuser and her associates have been investigating stress and its effects on Swedish workers. By monitoring the adrenaline and noradrenaline levels in the urine of workers, they have attempted to identify work conditions that cause particularly high levels of stress. During this resarch Frankenhaeuser and her associates found that males and females may react differently to certain types of stress. During rest and relaxation the sexes do not differ in their catecholamine secretion (when body weight is taken into account). But psychological and social stress conditions, she says, produce a different picture, suggesting that the adrenaline production system may be less reactive in females.

Adrenaline-excretion data were presented from several studies in which males and females were examined under stressful and nonstressful conditons. In one study male and female employees of the Swedish metal industry were compared while carrying out daily routine activities and while taking intelligence tests under time pressure. For the females, adrenaline output remained the same in both sessions. For the males, it increased significantly during testing. Similar results were obtained when 12-year-old boys and girls were compared in passive and active situations—watching a movie and doing mental arithmetic. Adrenaline secretion rose significantly for the boys during the active period, but not for the girls.

Since females performed as well as or slightly better than males on the tests in both studies, it is unlikely that the difference in adrenaline secretion was due to a difference in effort. The nature of stress on subjects, however, can be significant. So various other stress situations were imposed on subjects. For instance, repeated venipuncture, the procedure used for withdrawing blood samples, was applied to male and female students. Venipuncture is usually considered stressful in both males and females and has no distinct sex-role pattern. Even so, adrenaline secretion during venipuncture remained at the relaxed level in the females while it rose significantly in the males.

Females do, of course, respond to stress and produce adrenaline but perhaps not as readily as males. In the past most physiology research has been based almost completely on males, so it is unknown whether the adrenaline production difference is due to true physiological differences between the sexes. Women, for instance, might have a completely different and still undetected hormonal mechanism for stress response. Tests on women past menopause might clear up this problem. Even so, Frankenhaeuser suggests that the tendency of males and females to respond differently to requirements of the psychosocial environment by adrenaline release may not be linked to sex at all. Instead, she says, the response may be related to a learned behavior pattern that is more common in males than in females in Western society. Type A behavior, which has been correlated to coronary heart disease, seems to fit the pattern. Its characteristic features—fierce competitiveness, a sense of time urgency and impatience, constant struggling to meet deadlines and a strong need to be in control—are all likely to be products of the early social environment. "Hence," concludes Frankenhaeuser, "one might speculate about the possibility that the ongoing change in sex-role patterns will lead to a growing proportion of type-A women." This, in turn, may lead to a closing of the gap between the sexes in catecholamine production. But such equality of the sexes might also mean that women will be more susceptible to stress-related diseases. □

Zeugmatography zeroes in on tissues

It sounds like some strange Hollywood cinemagraphic technique. But it's not. Zeugmatography is a new scientific tool for looking at the inner structure of tissues that uses the principles of an old scientific tool, nuclear magnetic resonance (NMR) spectroscopy. P. C. Lauterbur of the State University of New York at Stony Brook described zeugmatography at this week's American Chemical Society meeting in Philadelphia. The technique involves 1) surrounding an object or animal with a uniform magnetic field produced by a large circular magnet; 2) irradiating the animal with certain radio frequencies and then 3) detecting the radio signals that are reemitted by atomic nuclei within the animal's tissues. The novelty of the system, Lauterbur says, is its potential for looking at the macroscopic structures inside intact objects. The technique produces soft, blurry-looking pictures that show mainly the distribution of water in tissues, since there are about 1,000 times as many water molecules in living organisms as other molecules. Lauterbur chose the Greek word *zeugma*, meaning the joining of two things, to describe the system, since the pictures are formed with the aid of both radio signals and magnetic forces.

Zeugmatography can detect some tissues, such as tumors, differentially. Why the water in some tumor tissues has different characteristics and shows up differently on the zeugmatogram is not known. Some tumor tissues may reemit radio waves slightly later than other tissues and this delay can perhaps be detected, Lauterbur says.

Before zeugmatography is applied either clinically or experimentally, questions such as how tissues differ and how the differences are exploited must be answered. The team is testing a circular magnet with a 16-inch central space and has ordered one with a 24-inch central space. How such strong magnetic forces will affect test animals is not yet known. There have been many reports of biological damage caused by magnetic forces, but it is "hard to sort the good work from the bad" in this area and many of these experiments are unrepeatable, Lauterbur says. There probably will be no serious effects from the magnetism, he suspects, but exposure to certain radio frequencies has to be closely monitored. Perhaps the main question to be answered is whether zeugmatography offers advantages over other available techniques for detecting the inner structures of soft tissues. Some new advances in X-ray radiography and the use of ultrasonics reveal soft tissues, but Lauterbur says he's hoping zeugmatography will provide a better differentiation among soft tissues than have other methods. □