Genetic clue to male homosexuality emerges

Researchers say they have taken a major stride toward identifying a gene that may importantly influence the development of some cases of male homosexuality.

The new evidence, published in the July 16 SCIENCE, suggests that a gene lying within a small stretch of the X chromosome, inherited by men from their mothers, contributes to the sexual orientation of a subset of homosexual men.

"We haven't identified the gene yet, and any theory of how it works is speculative," asserts Dean H. Hamer, a geneticist at the National Cancer Institute in Bethesda, Md., who directed the study.

However, a gene wedged into a tiny segment of DNA — containing perhaps as few as several hundred genes — probably performs functions linked directly to sexual orientation, Hamer proposes.

Other investigators have proposed that an individual's sexual orientation depends on the interplay of culture, family, hormonal influences, and inherited personality traits.

"If Hamer's data are replicated, this will be the only linkage of a gene to a high-level function performed by the [healthy] human brain," says psychiatrist Elliot S. Gershon, chief of the clinical neurogenetics branch at the National Institute of Mental Health, also in Bethesda, Md.

The failure of different scientific teams to confirm reports of genes linked to schizophrenia (SN: 11/12/88, p.308) and to manic depression (SN: 3/28/87, p.199) illustrates the importance of independent replication, Gershon notes.

Hamer's group recruited 114 men who met a strict definition of homosexuality. Participants described themselves as gay, felt sexually attracted to other men, fantasized mainly about men, and engaged in sex always or mainly with men.

Hamer and his co-workers estimate that 2 percent of all men and women meet this strict definition of homosexuality, although generally accepted figures for the prevalence of male homosexuality range from 4 to 10 percent.

Participants rated the sexual orientation of their fathers, sons, brothers, uncles, and male cousins. Interviews of 99 of those relatives confirmed nearly all of the ratings.

Only brothers, maternal uncles, and maternal male cousins displayed a markedly higher rate of homosexuality than the general population. Maternal transmission of homosexuality appeared even stronger in a study of 38 families, each of which contained two homosexual brothers and no more than one lesbian.

Hamer's team viewed these findings as an indication that one form of male homosexuality derives partly from a gene on the X chromosome. They employed 22 "marker" enzymes to make cuts at precise points along the X chromosomes of 40 pairs of homosexual brothers (including all those from the family study) and available members of their immediate families.

Thirty-three pairs of brothers displayed the same cluster of five markers bunched into a small region on the X chromosome, suggesting that these families possessed a maternally transmitted gene that predisposed them to homosexuality, the scientists assert.

Genes may play a role in at least some cases of homosexuality, but the seven pairs of brothers who did not both inherit the crucial bit of X chromosome also provide an opening to studying how the environment influences sexual orientation, Gershon points out.

Hamer's team now plans to use DNA markers with more pairs of homosexual siblings in hopes of isolating the key gene so its chemical functions can be deciphered. Gershon says the gene may affect other, nonsexual behaviors in both men and women.

Confirmation of the finding and isolation of the gene may clarify the evolutionary significance of genes that influence homosexuality, adds Richard C. Pillard, a psychiatrist at Boston University School of Medicine who has studied homosexual twins (SN: 8/22/92, p.117). — *B. Bower*

AI at work: From prisons to autos to space

The Tennessee Department of Correction had a tough problem. Faced with a prison population of 50,000 and a welter of more than 2,000 rules specifying lengths of sentences, criteria for probation, and numerous other details of incarceration, department personnel had trouble coping. They found it especially difficult to calculate accurately the duration of sentences.

Required by a 1990 federal court order to improve prison conditions and reduce overcrowding, the department decided to seek a software solution to its management woes. It turned to Andersen Consulting, a firm specializing in the application of artificial intelligence (AI) techniques to business problems, to develop the necessary system.

Now in use, the $14 million Tennessee Offender Management Information System (TOMIS) oversees the entire process, from sentencing through imprisonment to release. "[TOMIS] has reduced errors, streamlined business activities, and provided more accurate and timely information," report Tim Beck of the Tennessee Department of Correction and David Reynolds of Andersen Consulting in Nashville, Tenn.

TOMIS stands as an example of how knowledge combined with some form of reasoning — the basis of AI techniques — can be incorporated into information systems to solve complex business problems. It was one of 16 projects highlighted this week at the Innovative Applications of Artificial Intelligence conference, held in Washington, D.C.

"We were looking for real business successes," says Philip Klahr of Inference Corp. in El Segundo, Calif. "These applications are major accomplishments for AI." Klahr headed the committee that selected these projects from a wide range of submissions.

In most of the projects, the developers took advantage of computer programming techniques unique to AI research to capture certain types of knowledge — for example, the intricacies of how a vehicle is manufactured, together with the expertise required to estimate the cost of parts when engineers propose a new or modified design. The resulting computer program could then act as an assistant by generating, investigating, and recommending possible courses of action, and then justifying its decisions.

The Ford Motor Co. started developing its computer-aided parts estimation (CAPE) system in 1988. Initially, "senior management was skeptical that such an ambitious system would work," says Adam Cunningham, a Ford programmer in Baslidon, England. Put together in stages, the system now incorporates about 40 percent of the entire manufacturing process and is already in daily use at Ford facilities in Great Britain and Germany.

"We think CAPE is a major technical achievement," Cunningham says.

He cites the example of a car's electrical system, which by itself requires about 400 parts, most of which Ford purchases from suppliers. Estimators usually require two weeks to work out the cost of the electrical parts in a new design. Using CAPE, they can obtain a more accurate estimate in 30 minutes. "You get vastly improved control over costs," Cunningham contends.

On a considerably smaller scale, researchers at NASA's Ames Research Center in Mountain View, Calif., and their collaborators have developed a knowledge-based system that helps astronauts perform scientific experiments during space shuttle flights. Known as Principal Investigator-in-a-Box, this system collects data, analyzes the status of experiments, and recommends changes in procedure to maximize the value of the research performed within the severely limited time available to mission specialists.

Running on a single portable computer (a Macintosh PowerBook 170), PI-in-a-Box has been delivered to NASA for use on the Space Life Sciences-2 shuttle mission, scheduled for launch Sept. 10. — *I. Peterson*