Genes linked to baldness, missing teeth

More than a century after Charles Darwin described a family in India in which 10 men had sparse hair, small teeth, and "excessive dryness of the skin" during hot weather, scientists have pinned the blame for the malady on a gene—the first linked to baldness.

Anand K. Srivastava of the J.C. Self Research Institute of Human Genetics in Greenwood, S.C., and his colleagues report in the August NATURE GENETICS that they have isolated a gene which, when faulty, causes the Indian family's complaint, now known as anhidrotic ectodermal dysplasia. The researchers also pinpointed the specific mutations and deletions that cause the pattern of symptoms Darwin described.

Anhidrotic ectodermal dysplasia is one of 150 syndromes marked by defects in skin, hair, teeth, and nails. Together, these syndromes afflict 125,000 people in the United States.

Though it may seem odd that anomalies in a single gene can affect such distinctly different bodily features as hair, teeth, and sweat glands, the trio is linked by a basic fact of human development—each forms within 12 weeks of conception from embryonic skin. The embryo's outer surface, or ectoderm, develops into hair, nails, skin glands, nervous system, and sensory organs.

Anhidrotic ectodermal dysplasia, which means abnormal growth of the ectoderm, including an inability to sweat, appears mainly in men. "It is remarkable that no instance has occurred of a daughter being thus affected," Darwin noted in his report on the Indian family.

Such an inheritance pattern had long indicated to scientists that the genetic flaw responsible for the disorder is located on the X chromosome. Women have two copies of the X chromosome, so one normal copy can compensate for a faulty one. Men have only one X chromosome, so they cannot escape the consequences of an error.

Srivastava's team began its quest for the gene with a woman who had the disorder. She also had a genetic anomaly: A piece of her X chromosome was spliced into another chromosome. This led the team to focus on the transplanted segment. Once they had found the gene, they analyzed it in 15 other patients. All 15 had either deletions or mutations in the gene.

"Now we have to learn how this gene functions," Srivastava says. The researchers plan to find out first in the *Tabby* mouse, which has the rodent counterpart of the human disorder.

"We want to introduce a normal gene into this mouse and see if we can [repair the defect]," Srivastava says. "Once we know more about the mechanism of the gene and its function, it may help in the prevention of baldness."

In a separate study in the same journal, Christine Seidman of the Howard Hughes Medical Institute at Harvard Medical School in Boston and her colleagues say they have located the genetic flaw responsible for a rare developmental failure in which specific teeth fail to form. They found the mutation by studying a family in which 12 of 28 men and women lacked the same two teeth—a molar and a premolar.

The researchers then analyzed the DNA of affected family members to try to identify distinctive features that might account for the missing teeth. They found a mutation in a region of *MSX1,* a gene that makes a protein capable of regulating other genes. This mutation occurs in a sequence of the gene that rarely varies, even from species to species, and disrupts development of specific teeth, the researchers say.

Irma Thesleff of the University of Helsinki comments in the journal that *MSX1* belongs to a gene family with an important role in regulating human development. Although the normal function of the ectodermal dysplasia gene is unknown, she says, its effects when flawed imply that the gene is also "part of some basic developmental regulatory mechanism." — *S. Sternberg*

Bug sprays may bug you, too—for a day

People whose homes have been sprayed for bugs frequently complain of symptoms that resemble mild insecticide poisoning—headaches, burning eyes, runny noses, nausea, even tightness in the chest. However, such symptoms are less likely to stem from reactions to the pesticide than to the added solvents that make it sprayable, a new study concludes.

These emulsifiers and propellants account for up to 95 percent of sprayed material. Though manufacturers label them inert, this designation refers only to the fact that they are not part of the active pesticide, points out John A. Bukowski, formerly of New Jersey's Pesticide Control Program in Trenton. In fact, he notes, many of these solvents, which tend to enter the air far more readily than the pesticides do, are quite irritating.

To see whether the solvents might reach concentrations likely to provoke symptoms, Bukowski's office teamed up with New Jersey's Environmental and Occupational Health Sciences Institute in Piscataway to study apartments treated with the insecticide chlorpyrifos.

Exterminators sprayed just the perimeter of two identical, unoccupied apartments, hitting baseboards and crevices along the edges of the floor. In another two, they sprayed a fine mist of the pesticide over the entire floor area, including carpets.

Computer models had indicated that solvent concentrations in such unventilated apartments would peak in 2 to 4 hours, suggesting that the dwellings should be ventilated for 3 to 6 hours. Though the concentrations peaked as predicted at about 22 milligrams per cubic meter of air, they didn't do so until 10 to 12 hours after treatment.

Even after 24 hours, solvents remained elevated in three of the apartments at more than twice their prespray concentrations, the researchers report in the August ENVIRONMENTAL SCIENCE & TECHNOLOGY.

These solvents—some of which are found in paints or resemble volatile chemicals emitted by glues and fabric in new furniture and carpets—have been associated with sick building syndrome, notes Bukowski, now at the University of Prince Edward Island in Charlottetown. "What we're basically showing," he says, "is that you can get a sick building syndrome for a day or so from an insecticide application."

Robert Dyer, assistant director of the Environmental Protection Agency's National Health Effects and Environmental Research Laboratory (NHEERL) in Research Triangle Park, N.C., is not convinced. Bukowski's assertion that the elevated solvents could cause symptoms comes from comparing concentrations of the unidentified volatile organic chemicals (VOCs) emitted by chlorpyrifos to symptom-provoking concentrations of a well-defined mix of 22 VOCs studied at NHEERL. Unless the two groups of VOCs match, Bukowski's group may be "comparing apples and oranges," Dyer says.

The new study does "point to an issue that's very important," however—the need to improve labeling on when and how long to ventilate an area that has been treated, says Lynn R. Goldman, EPA's assistant administrator for prevention, pesticides, and toxic substances. Few pesticides developed for indoor use recommend vacating treated premises temporarily, Bukowski notes, or give airing-out instructions beyond "ventilate adequately."

Currently, EPA is reevaluating information and labeling for all pesticides registered before 1985. So far, Goldman told SCIENCE NEWS, "in every case, we're finding a need to change how [pesticides] are used," which can include ventilation requirements. In the near future, she says, expect labeling with more explicit prescriptions on how long to air out treated areas, based on data for additives as well as active ingredients. — *J. Raloff*