Face rashes linked with use of VDTs

A Norwegian study has tentatively linked mysterious facial rashes among Scandinavian office workers with electrostatic fields generated by video-display terminals (VDT's). Details of the research by Walter Cato Olsen of the Chr. Michelsen Institute in Bergen, Norway, were presented in Washington recently at a National Academy of Sciences symposium on VDT's and vision (SN: 8/29/81, p. 137).

According to Olov Östberg, who made the presentation, there have been roughly 100 cases reported in Sweden and Norway of VDT-workers developing rashes, another 10 or 12 "recognized cases" in Great Britain. Östberg, an occupational-health researcher with the Central Organization of Salaried (white-collar) Workers in Sweden, told SCIENCE NEWS that the reported outbreak of rashes "is not dramatic, so you may have to be aware of the mechanism before you notice it." But where it has been noticed, up to five of eight VDT-operators in a given office have been affected, he claims.

Olsen's study included 150 measurements. Sponsored by the Norwegian Directorate of Labor Inspection, and released in April, it looked at 10 offices (including some where rashes had been reported), 14 operators and 26 VDT units. Body-voltage readings for two members of the investigating team were also taken at all sites visited.

Rashes are characterized by itching, a slight redness and a few pale pimples. Symptoms develop after VDT-work periods ranging from a couple of hours to several successive days, and disappear within a day or two of work cessation, such as over a weekend. Investigation of 12 affected operators at Televerket in Bergen by A. Nilsen of the University of Bergen's dermatology department "established a probable connection between the facial rash and occupational activities" for half, Olsen says. Nilsen's work also suggests rosacea, perioral dermatitis, contact- and photo-contact dermatitis can be ruled out as causal factors.

VDT's based on cathode-ray tubes employ high voltages to generate the electric fields that accelerate their electron beam. It is the beam's excitation of phosphors on the viewing screen's inner surface that creates a VDT's images. Potential differences of 10^4 volts are common, and if the equipment is not deliberately shielded, Olsen says, "high voltages may extend into the air surfaces surrounding the units."

What's more, charge accumulation from static electricity may raise the electric potential of the human body several thousand volts above ground potential. "Having acquired a charge, the human body will discharge in a time that is related to the resistivity of the surroundings, which in turn is influenced by the humidity of the ambient air," Olsen explains. "If highly insulating footwear and floor coverings are in use under conditions of low humidity, the rate of charge dissipation will be minimal and elevated body potentials may be sustained over long periods of time."

Olsen notes that rash incidence fell in offices where measures were taken to prevent static electricity. Under the hypothesis that VDT operators in the presence of an electric field might function as electrostatic collectors of charged airborne particulates, he conducted field surveys to measure electric-field and aerosol-concentration characteristics under conditions reported to exist when rashes occurred. "If irritant fractions of the ambient aerosol could be shown to be precipitating at abnormal rates under circumstances when rashes occurred, a probable cause ... would be identified," Olsen claims. It might also explain the oft-reported eye irritation, he adds.

VDT screens carried a positive charge. Calculated electric potentials ranged from nearly zero to more than 10,000 V in extreme cases; the average was 2,250 V. The charge potential measured in VDT operators varied from −2,000 V to +4,000 V. Of 78 body-potential readings, roughly 30 percent were positive, 20 percent near zero and 50 percent of negative polarity. Twenty-four body readings exceeded 1,000 V, "and *all but one* of these represented measurements in areas associated with rashes," Olsen reports. The high voltages were distributed equally among confirmed rash-prone operators and others in the same area, including the investigators. Most body potentials were negative, in the range of −500 to −2,000 V (however, one rash-prone operator was consistently positive, with peak readings of 4,000 V when the humidity was low).

Using a piezoelectric mass analyzer, Olsen measured concentrations of suspended particulates. Charged particles move in the presence of an electric field, and Olsen found the particle-precipitation rate roughly proportional to the absolute value of the difference in voltage between the VDT screen and collection surface (such as a human face 50 centimeters in front of it). Particle-deposition rates exceeded 10^4 particles per millimeter per hour under conditions said to simulate those during rash outbreaks. Olsen claims, "This flux is at least a factor of 10 higher than the flux in the absence of an external field." Olsen adds that his data suggest any increase in deposition will be proportional to the strength of the field, independent of its polarity.

Olsen acknowledges several apparent inconsistencies encountered: For example, facial rashes normally occurred on the cheekbones and chin, not the central forehead and nose — places where the electric field intensity would be expected to be just as high. "One possible explanation," he posits, "may be that the field-enhanced deposition of aerosols in these regions ... is influenced by the air turbulence and humidity variations caused by breathing."

Another controversial element raised by symposium participants is why non-VDT workers in high-electric-field situations haven't reported similar problems. Olsen suggests the chemical makeup of the indoor air pollution, sensitivity of a worker's skin, and electric-field differentials caused by the specific equipment and workplace design will determine whether a rash occurs. □

Tooth decay puzzle dissolves away

At one time, dentists used to poke around to locate areas of tooth enamel that were softer than normal, especially between teeth and along the gumline. These areas, called white spots, were puzzling because the subsurface had decayed more than the hairbreadth-thick surface layer.

Now two researchers think they have found a mathematical and chemical model to account for the mystery. Their analysis also may have interesting implications for the environmental degradation of marble structures and for geological processes like the layering of sediments.

Reporting in the Aug. 28 SCIENCE, Edward L. Cussler of the chemical engineering and materials science department at the University of Minnesota in Minneapolis and John D. B. Featherstone of the Eastman Dental Center at the University of Rochester, present a model of what happens when an acid comes into contact with a highly porous solid. To calculate the dissolution rate for this situation, they assumed that the chemical reactions in the solid are much faster than the diffusion rate so the reactions reach equilibrium.

The equation they developed predicts that for some solid ionic materials, extra mineral would precipitate in the pores of a solid being dissolved by acid. Thus, although demineralization occurs at the solid's surface, remineralization can occur near this surface, and further demineralization can occur deeper inside the material. This matches what happens in tooth enamel when white spots form.

Cussler tested the predictions, initially using ordinary lab chemicals and grocery-store gelatin. He created a dilute suspension of an insoluble hydroxide in a gel, over which he poured an acid. In the case of calcium hydroxide and hydrochloric acid, within hours he saw a band of precipitate form just below the acid-gel interface. For a mixture of calcium hydroxide and silver oxide, nitric acid caused precipitation of calcium hydroxide near the interface but dissolution of solid mate-

rial below the interface. He also found that when a buffered acid attacked calcium carbonate, it dissolved at the acid front, precipitated just ahead of the acid front and dissolved well ahead of this front. The same thing could happen to marble, which consists primarily of calcium carbonate, under the right conditions.

Featherstone says tooth enamel is a porous material, which is not chemically inert. It consists of crystals of a mineral related to hydroxyapatite held in a matrix of water, protein and lipid. Tooth decay occurs when bacteria in the plaque on the tooth metabolize sugars to produce organic acids, such as lactic acid, that attack the enamel.

Featherstone has been studying the physical chemistry of dental decay, especially diffusion processes. He is interested in learning how to slow down decay processes and repair damage, functions that saliva performs naturally. He says the mathematical model he and Cussler developed is a big step in understanding tooth decay. Now, they are designing experiments to check and refine the model and trying to come up with chemically useful methods that can be applied to all porous solids. So far, Cussler and Featherstone have investigated more than 20 systems that show analogous behavior.

Cussler and Featherstone are both struck by how simple the basic idea behind their model is. It's the kind of insight that gets other scientists to say, "Why didn't I think of that?" □

Violence on TV: A ten-year update

Early evidence that televised violence sparks aggression in some viewers has gained support from a new update of the Surgeon General's 1972 report on Television and Social Behavior. After reviewing more than 300 studies of television's effect on viewers, Eli Rubinstein, a member of both the Surgeon General's earlier advisory committee and the update task force, told SCIENCE NEWS that "the vast majority of the studies confirm the original conclusion that there is a causal relationship between televised violence and later aggression."

Rubinstein and colleagues on the review committee outlined the update in Los Angeles last week at the annual meeting of the American Psychological Association. Full details of their report, which also includes analyses of the cognitive and social effects of heavy TV viewing on the elderly and the very young, should be published by December, according to spokesmen for the National Institute of Mental Health, which sponsored the update.

In 1972, Surgeon General Jesse Steinfeld called for "appropriate remedial action" by broadcasters to limit violence in children's programing (SN: 4/1/72, p. 214). "If his statement was warranted then — and I believe it was — it is even more so now," says Rubinstein. "Not only is there further documentation of the adverse relationship between TV violence and later aggressive behavior, the newer research shows influences of television on the viewer much beyond the issue of violence."

A census of characters and their occupations in both prime time and children's television programs shows that television paints a discrepant view of the world, says Alberta E. Siegel, a Stanford University psychologist who contributed to the update. Three times as many men as women appear on television, where the most common jobs are in law, medicine and policework, she reports.

"Scientists are rare in the TV world," Siegel says. "Much commoner are prison guards, jail matrons, detectives and judges." Stereotypes of the elderly are perpetuated on most programs, she says, where "the elderly are typically shown as ineffective, sexless and pitiable."

As a window on a world with which children have little experience, television strongly shapes the social attitudes of young viewers, Siegel asserts. "There's fairly good evidence that children accept as authentic the portrayals that they see on television."

J. Ronald Milavsky, vice president for social research with the National Broadcasting System, dismisses the idea that TV should reflect statistical reality as an unsupported assumption. "I don't think entertainment should be held to that sort of standard," he told SCIENCE NEWS, pointing out that a content analysis of Shakespeare's plays would show that they do not accurately reflect the experiences of an average citizen in Elizabethan England.

Results of Milavsky's three-year longitudinal field study of several hundred children and teenagers and the long-term effects of their viewing habits will be published for the first time in the Surgeon General's update. "I think more children have had nightmares from fairy tales read to them than from television shows they've watched," says Milavsky, who reports that his study found no evidence that television violence was causally linked to the later development of aggressive behavior patterns.

Jerome L. Singer, director of the Family Television Research and Consultation Center at Yale University, believes a frightening TV program can have much stronger effects on a child than a frightening fairy tale because of the usual absence of an adult during a child's TV viewing. However, parental reassurances can boost the positive effects and buffer negative effects of any TV program. With evidence that children as young as six-months-old are already attentive to television, he says parents need to recognize TV as more than an extraneous and occasional intruder in their child's life. □

A bone to pick: How to date bones

In 1974 a group of scientists using a new method for dating fossils raised a prospect that sent shivers down the spines of archaeologists worldwide: Human nomads could have come to North America during an ice age as long as 70,000 years ago. These findings by Jeffrey Bada of Scripps Institution of Oceanography, Roy Schroeder, also then of Scripps, and George Carter of Texas A & M University, are challenged in the Aug. 28 SCIENCE by James Bischoff and Robert Rosenbauer of the U. S. Geological Survey (USGS) in Menlo Park, Calif.

The issue is not when did anatomically modern man come to North America, but rather, how old are the samples in question? The USGS scientists used a dating technique called uranium series dating. A living organism does not contain uranium, but absorbs it from the soil that surrounds it after death. You can learn the sample's age if you ascertain, from decay rates and the accumulation of decay products, how long the uranium has been in the sample.

To confirm that the uranium series tests for these fossils are valid, Bischoff and Rosenbauer double-checked their results by testing two independent decay schemes. U-238 decays into thorium-230, and U-235 into protactinium-231. "If there is any perturbation in the decay schemes, the dates won't agree," Bischoff said. "Our results not only are internally concordant, but they are in good agreement with the geological evidence."

Bischoff and Rosenbauer find that the Del Mar skeleton samples are about 11,000 years old, compared to the 48,000 years cited by Bada and his colleagues. The Sunnyvale sample is found to be about 8,300 years old, compared to 70,000 years.

Bada and his colleagues had used a method called amino acid racemization because fossils older than 45,000 years cannot be dated by the standard carbon-14 dating procedure. The amino acid racemization process is based on the fact that amino acids can exist in two mirror-image forms, left- and right-handed, or L- and D-isomers. Only the L-isomers are found in living protein, but after an organism dies, the amino acids slowly change to the D-form. This ratio can be measured and the age of an organism calculated.

Bada told SCIENCE NEWS that the ages indicated by uranium series testing are minimum ages. "What you're really dating with the uranium series is when the uranium became fixed in the sample, not the sample itself," he said. Because the real ages of the samples could be tens of thousands of years older, Bada says, Bischoff's data substantiate his previous findings. "The uranium series method hasn't been used extensively," he said. "It's fraught with problems." □