

Center for
Research on
Occupational and
Environmental
Toxicology

NEWSLETTER

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cTRAIN Stops in Southern Oregon, Provides Orchard Safety Training

Can computer-based training effectively train people who have never used a computer? That was the question Dr. Kent Anger and his research team sought to answer in January, when they provided cTRAIN computer-based ladder safety training to the orchard staff of Oregon’s Bear Creek Corporation. This safety-training program marks a recent collaboration between CROET and the large Medford-based company, which is also home to Harry and David catalogs.

The training was set up in CROET’s mobile training facility. Over 8 days, all 109 of Bear Creek’s orchard staff came to the mobile testing/training facility (which visited each orchard group) and completed the training in Spanish. "The challenge was to develop easy-to-administer computer based training that would be effective for an agricultural workforce that included people who had no formal education, and thus no experience with computers, as well as people who had attended college," said CROET’s Dr. Kent Anger, developer of cTRAIN — And after they completed the training, everyone seemed satisfied with the program. Asked to rate the training, 59% of employees rated it “excellent,” 35% rated it “good,”



and 6% rated it “OK-neutral”. No one rated it “not very good” or “poor”, the lowest rating choices offered.

Keith Emerson, Director of Bear Creek’s East Valley Orchards & Environmental Program, led the collaboration for the company. He said he was “entirely satisfied with Dr. Anger’s efforts to take a subject that we have had a hard time with—orienting our workers, and trying to get a consistent and quantifiable training module put together to help us with a safety problem that had been growing every year.”

“There is high anxiety about using computers (‘I might fail or break it’) but an equally high interest in learning how to use them”, said Annika Forester of Bear Creek Academy (the training arm of the corporation). “There is a mystique about computers, but all of the workers’ children are in school and learning how to use them. This training will have a secondary impact of enabling our workers to use computers, which have become not only an employment skill, but also a basic life skill, for example, using an ATM or an information kiosk at the DMV.”

The collaboration began when Dr. Anger met with Bear Creek to ask them to work together on a grant application. They agreed, but wanted to begin work right away because they thought cTRAIN could be a useful supplement to their already extensive training programs. Using a federal grant and CROET outreach funds, Kent and staff members Tami Ammerman and Jeff Stupfel, visited Bear Creek to take pictures and movies of orchard staff using ladders. In this way, the training would be tailored to Bear Creek orchard needs and would include pictures of the people taking the training.

The training content was developed from interviews with Keith Emerson, Annika Forrester and Benito Barajas, an orchard manager. Content was initially written in English and then translated into Spanish. The Spanish-language training

program was “pilot tested” in December with 10 orchard workers and supervisors, which led to a number of fine-tuning changes in the content.

In addition to training, almost half the orchard staff (51) volunteered to participate in an additional research study involving observation of their ladder work practices before and after training. Volunteers received a shirt for participating, with a pear, Bear Creek, and OHSU embroidered on it, along with “Knowledgeable workers create a safe workplace”, in Spanish.



Returning to Medford in January, Kent and Tami observed the volunteers’ work practices during ladder work in the orchards while Jeff, who speaks Spanish, began training 5 people at a time in CROET’s specially-equipped mobile testing/training facility, which is set up for training and testing. Jeff’s role was to set up the computers and answer questions, and to get the participants’

evaluation of the training afterwards. He also gave added help to those who could not read to be sure they were actively using the ‘spoken content’ option in cTRAIN. After the training, Kent and Tami continued making observations to find out if the training changed actual work practices in the orchards.

Most of the orchard staff had worked in the orchards for several years and knew the safest work practices, whereas others were very new to Bear Creek. Overall, the median average score on a ladder safety test given before training was 80% (50% was chance)—after training, the average score increased to 95%. A common practice before training was to place pruning loppers over the shoulders or to hold them close to the face while climbing ladders—a dangerous practice— so changing this behavior was a key point of the training. After training, orchard workers were rarely seen with the loppers closer than 12 inches to the face, based on study observations.

The data are still being analyzed.

Bear Creek liked the training program enough to ask Kent and his laboratory to also provide respiratory protection training, which CROET had developed earlier with the International Union of Painters and Allied Trades. The training was modified to focus on pesticides and on the particular equipment that is used at Bear Creek. All 24 Bear Creek employees who apply pesticides completed the training successfully.

Dr. Anger has won two federal research grants to study the intervention effectiveness of computer-based training using the cTRAIN program. This initial grant funding was combined with CROET outreach funds to support the Bear Creek ladder safety project. Computer-based safety training effectiveness in the food services industry, drywall finishing trades and research laboratories has also been investigated through this grant. A new grant will use cTRAIN for safety training in Oregon vineyards in collaboration with Leda Garside, R.N. of Tuality Health Care Foundation.

Find more information about the cTRAIN projects at <http://www.ohsu.edu/croet/faculty/anger/> and at <http://home.comcast.net/~neta-lo/>.

CROET Scientists Participate in 2004 Brain Fair

Vivaldi had it wrong—there are actually five seasons in a year! The fifth season is Brain Awareness Season, which begins early in February with a series of fascinating talks by some of the leading minds in brain research, and culminates in late March with Brain Awareness Week, which is capped by a weekend of mind-expanding fun at the OHSU Brain Fair, held at the Oregon Museum of Science and Industry (OMSI) in Portland, Oregon. Attendees of this year's fifth annual Brain Fair had the opportunity to visit with CROET scientists and to see some of the amazing work that is emanating from CROET's research laboratories.

Brain Fair veteran Tammy Ammerman, from Dr. Kent Anger's Neurobehavioral Toxicology Laboratory, demonstrated the Behavioral Assessment and Research System (BARS), a computerized testing system that allows researchers to assess subtle changes in nervous system function that may occur as a result of exposure

to chemical or physical hazards in the workplace. Participants had the opportunity to use the BARS system, and to experience first hand what it's like to be tested on a variety of nervous system functions, such as memory and reaction time. Learn more about BARS and other computerized assessment and training systems online by visiting <http://www.ohsu.edu/croet/faculty/anger/>.



Tammy Ammerman (right)

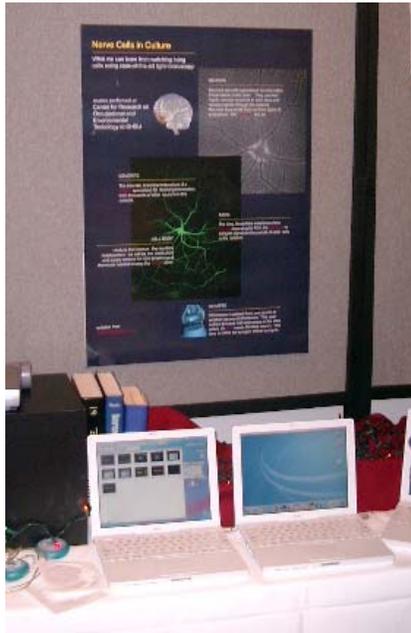
Another veteran Brain Fair participant, Dr. Stefanie Kaech Petri, presented some of the work she has been involved with as a member of Dr. Gary Banker's laboratory. Stefanie showed amazing time-lapse videos that document the growth and differentiation of individual nerve cells and

demonstrated how this growth can be manipulated in ways that may eventually produce therapies for re-connecting damaged nerves to muscles (see CROET Newsletters vol. 11, no. 1 & 2). Stefanie also demonstrated video images of the internal workings of

nerve cells, where proteins produced in a nerve cell's body are transported long distances to the ends of its axon, where they are used for critical nerve functions. See these videos for yourself online at <http://www.ohsu.edu/croet/faculty/banker/bankerlab>.

New to Brain Fair 2004 was Dr. Pam Lein, who recently came to CROET from the Johns Hopkins University Bloomberg School of Public Health (see CROET Newsletter vol. 11, no. 2). Dr. Lein and her

enthusiastic laboratory staff, Donald Bruun, Michelle Massoth, Melissa Mohott-Siebert and Yang Dongren, prepared a demonstration of their research on the adverse effects that some chemicals may exert in the developing nervous system and how this can alter learning and behavior. They demonstrated how memory can be tested using a water maze, in which mice must use visual and spatial cues to remember



Stefanie Kaech Petri's Brain Fair Exhibit

where a hidden platform is located, and how exposure to certain chemicals during development alters this behavior. More information about the research of Dr. Lein's laboratory can be obtained online at <http://www.ohsu.edu/croet/faculty/lein/>.

Brain Awareness Week is an international effort organized by the



Michelle Massoth explains research being conducted by the laboratory of Dr. Pam Lein

by the Dana Alliance for Brain Initiatives to advance public awareness about the

progress, promise, and benefits of brain research. The Dana Alliance is joined by partners in the United States and around the world, including medical and research organizations; patient advocacy groups; the National Institutes of Health and other government agencies; service groups; hospitals and universities; K-12 schools; and professional organizations. OHSU's Brain Awareness 2004 was presented by OHSU in partnership with OMSI and Oregon Public Broadcasting, and with the generous support from Pfizer.

Karen Drake earns Oregon Occupational Health Nursing Worksite Award

The recipient of the first Oregon Occupational Health Nursing Worksite Award is Karen Drake, BSN, COHN-S, Health Services Manager of ESCO Corporation in Portland Oregon. The award, jointly sponsored by the Center for Research on Occupational and Environmental Toxicology and the Oregon State Association of Occupational Health Nursing recognizes occupational health nurses who are conducting projects at their worksite to improve worker safety and health. Ms. Drake described a current ESCO project aimed to decrease musculoskeletal injuries in the flogging/finishing area of ESCO's Plant 3, an area of heavy material handling in which workers are at high risk for injury. The 2003 award of \$1500 will be used to purchase an ergonomically improved table that will eliminate the need to carry and throw large heavy castings.

Issues: Nutritional Hair Analysis

CROET's Toxicology Information Center receives occasional calls from people who report suffering from chronic and often debilitating conditions, including fibromyalgia (FM), chronic fatigue syndrome (CFS), multiple chemical sensitivity (MCS), and non-specific neurological diseases. These conditions all share one thing in common: medical science is still trying to answer critical questions related to their causes, diagnoses and treatment. As a result, frustrated and desperate sufferers often seek any information out there that may help alleviate the problem—and “out there” often means the Internet. Many Internet sites that discuss these maladies suggest that toxic chemicals are partly or wholly responsible, which may or may not be true (we just don't know yet); however, many other sites offer a variety of diagnostic tests to diagnose, and special nutritional supplements to treat, these and other conditions. One type of diagnostic testing being offered is nutritional hair analysis, in which a single hair sample is analyzed for the presence of a variety of minerals, both toxic and nutrient.

On the surface, hair analysis for nutritional or toxic imbalances seems logically reasonable. As hair grows, minerals and other substances currently within the body are deposited and fixed within the protein hair matrix, thus providing a historical record of one's nutritional and health status at the time the hair was being formed. This, at least, is how hair analysis is being presented. But, for a variety of reasons, this description is overly simplistic. Following is a brief discussion of the problems inherent in the use of hair analysis as a diagnostic tool.

Hair analysis laboratories

In a study reported in 1985, researcher Stephen Barrett, MD, provided identical hair samples to several hair analysis laboratories, but found wide inter-laboratory differences in the reported levels of most of the minerals that were assayed. There were also discrepancies among laboratories about what constitutes “normal” values for many of the minerals analyzed, such that any given hair mineral concentration might be reported as high by one, but normal or low by another laboratory. Many laboratories assessed by Barrett provided computer-generated interpretations that suggested a variety of conditions the client might be suffering, and recommended various vitamin or other supplements designed to correct the reported mineral imbalances. These findings demonstrated that hair testing was not reliable as a clinical diagnostic tool, especially since the people whose hair was tested were all healthy individuals.

Since 1985, laboratory methods have generally improved, due largely to implementation of the Clinical

Laboratory Improvement Act (CLIA) of 1988. The general improvement since 1988 in laboratory standards led another group of researchers to reconsider the findings of Barrett. Reasoning that there should be no significant variation between test results on hair taken from a single donor, Dr. Sharon Seidel and colleagues from the California Department of Health Services evaluated inter-laboratory agreement among six of nine laboratories currently offering hair analysis tests. In a 2001 [Journal of the American Medical Association](#) report, their data suggested that the situation regarding hair analysis had not changed. Their conclusion was that “hair mineral analysis from these laboratories was unreliable”. The authors further recommended that “health care practitioners should refrain from using such analyses to assess individual nutritional status or suspected environmental exposures”.

These two reports make it apparent that analytical laboratories need to address a variety of problems to assure that hair mineral analysis becomes reliable. For example, the techniques typically used to prepare hair samples for analysis can introduce errors for many of the elements being measured. Hair preparation procedures that affect analytical accuracy include: sample collection and storage methods, hair washing protocols, and digestion techniques, which in turn affect recovery rates for the various elements, internal quality control performance (analytical drift over time), and minimum detection limits for each element for the specific analytical method being used. Most of these problems can be addressed through proficiency testing strategies overseen by testing agencies. The testing agency would provide laboratories with samples of known composition, in this case hair containing minerals in quantities known only by the overseers. The laboratory would analyze the samples as part of its normal routine and report the results to the testing agency. The laboratory would then be provided with a report showing how closely their results agree with the known or standard value, and where necessary, could take appropriate action to improve performance.

What constitutes normal?

The problem of assuring laboratory accuracy is not insurmountable, and some hair analysis labs do already implement CLIA's good laboratory practices. But even if a laboratory could consistently and accurately measure the mineral composition of a subject's hair, how do we determine what is “normal”? And, if a mineral is “high” or “low”, what does that actually tell us about the health

of the individual? Normal ranges of hair minerals have not been defined from a health standpoint. For most elements, no correlation has been established between hair level and other known indicators of nutrition status. As an example, it is possible for the hair concentration of an element, such as zinc, to be high even though the body has a deficiency of zinc. Moreover, the level of certain minerals can be affected by the color, diameter and rate of growth of an individual's hair, the season of the year, the geographic location, and the age and gender of the individual. Another factor to consider is that hair mineral content can be affected by exposure to various substances such as shampoos, bleaches and hair dyes. No analytic technique provides a reliable determination of the source of specific levels of elements in hair as bodily or environmental. Finally, since hair grows slowly and at different rates for different individuals, hair even close to the scalp is usually several weeks old and thus may not reflect the current body condition for purposes of health diagnosis. Therefore, with all the unknowns that can affect hair mineral composition, it would be prudent to treat the use of multi-elemental hair analysis as a single means of clinical diagnosis as unproven medical practice. Any single laboratory finding should always be considered together with a subject's history and physical examination, and with the knowledge that laboratory hair analyses are subject to many caveats. For multi-element hair analysis, it is not currently possible to know just what the results mean.

What can hair mineral analysis be used for?

A 1985 position paper on hair analysis issued by the American Institute of Nutrition/American Society for Clinical Nutrition concluded that, although hair analysis may have some value for comparing *population groups* as to status of various minerals or assessing exposure to heavy metals, assessment of *individual* subjects appears to have "almost insurmountable difficulties." The paper went on to state that hair analysis might best be reserved for experimental studies designed to evaluate its *potential* as an indicator of nutrition status and perhaps for some public health surveys. Thus, hair analysis seems potentially useful in experimental medicine but its use in clinical medicine for diagnosis, prognosis, and therapy will remain limited until validation by standard methods of clinical investigation is achieved.

Hair analysis does have limited value as a screening device to detect exposure to toxic metals, such as mercury and arsenic, but not to measure their absolute concentrations. Using hair analysis as an exposure or diagnostic tool for metal contamination is severely

limited by difficulties in distinguishing between internal and external sources of metals. Moreover, it must be remembered that exposure, as suggested through hair analysis, does not usually correlate with any particular health outcome. The only well-documented hair/target tissue relationship that exists is between a mother's hair and fetal brain levels of methyl mercury, with the critical effect being neurological abnormalities in the offspring. As for arsenic and other toxic metals, data do not yet exist that offer disease-predictive value (e.g., long-term health outcomes). Taken in the context of other data, such as a subject's physical examination, history, and potential for actual exposure (e.g., in the workplace), hair analysis may nevertheless provide useful supportive information as relates to the diagnosis of suspected chronic arsenic poisoning. Thus, in the absence of dose-response data, hair analysis may simply offer a better sense of exposure, and may raise some suspicion of possible exposure and effect in the context of other supportive data.

One other area in which hair analysis may be useful is in the detection of illicit drugs and/or their metabolites. These may include cocaine, marijuana, ecstasy (MDMA), opiates, methamphetamine and phencyclidine (PCP). Since most drugs and their metabolites are quickly eliminated from the body in urine, hair offers the possibility to detect drug exposure that has occurred weeks or months prior to hair sample collection. Detection of drug metabolites in hair offers the best indication of actual drug use, since the question of external contamination (for instance, from marijuana smoke or cocaine dust) is eliminated. Moreover, there are data suggesting that wash procedures can distinguish contaminated hair from user hair, thus distinguishing passive exposure from actual use. False positive tests are a potential problem in persons who inadvertently inhale or ingest small quantities of illicit drug, for instance in those who may be in the constant presence of a drug abuser. Thus, since illicit drugs or their metabolites are not a normal part of an individual's environment or diet, drug hair analysis may be a useful test for detecting use assuming tight laboratory quality control measures are maintained.

It is easy to understand the frustration and desperation of those who suffer health conditions that are not yet well understood, diagnosed or treated. In such a situation, most of us would be willing to try any reliable procedure, even if it was very expensive. However, nutritional hair analysis will not provide the answer, and at this time, is likely to complicate matters through confusion and false hopes.

Center for Research on Occupational and Environmental Toxicology

CROET, the Center for Research on Occupational and Environmental Toxicology at Oregon Health & Science University, conducts research, provides consultations and offers information on hazardous chemicals and their health effects. CROET includes approximately 100 scientists and research staff exploring a range of questions relating to health and the prevention of injury and disease in the workforce of Oregon and beyond. CROET's Toxicology Information Center is open to the public and is staffed to answer Oregonians' questions about hazardous substances in the workplace and elsewhere. CROET's Web site also provides answers to questions about industries found in Oregon through links on a series of pages devoted to industry-specific topics.

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OUTREACH

CROET will provide exhibits at the following conferences.

HealthCare Ergonomics Conference

DoubleTree Hotel Portland – Lloyd Center - Portland, OR

July 26-28, 2004

Southern Oregon Occupational Safety & Health Conference

Smullin Center – Medford, OR

October 20-21, 2004

Central Oregon Occupational Safety & Health Conference

Eagle Crest Resort - Redmond, OR

September 21-24, 2004

Western Pulp & Paper Workers Safety & Health Conference

DoubleTree Hotel – Jantzen Beach
Portland, OR

November 30 – December 3, 2004

2004 Northwest Occupational Health Conference

Portland Airport Sheraton - Portland, OR

Short Course: Emerging Issues in Toxicology (Oct. 11, 2004)

October 13-15, 2004

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