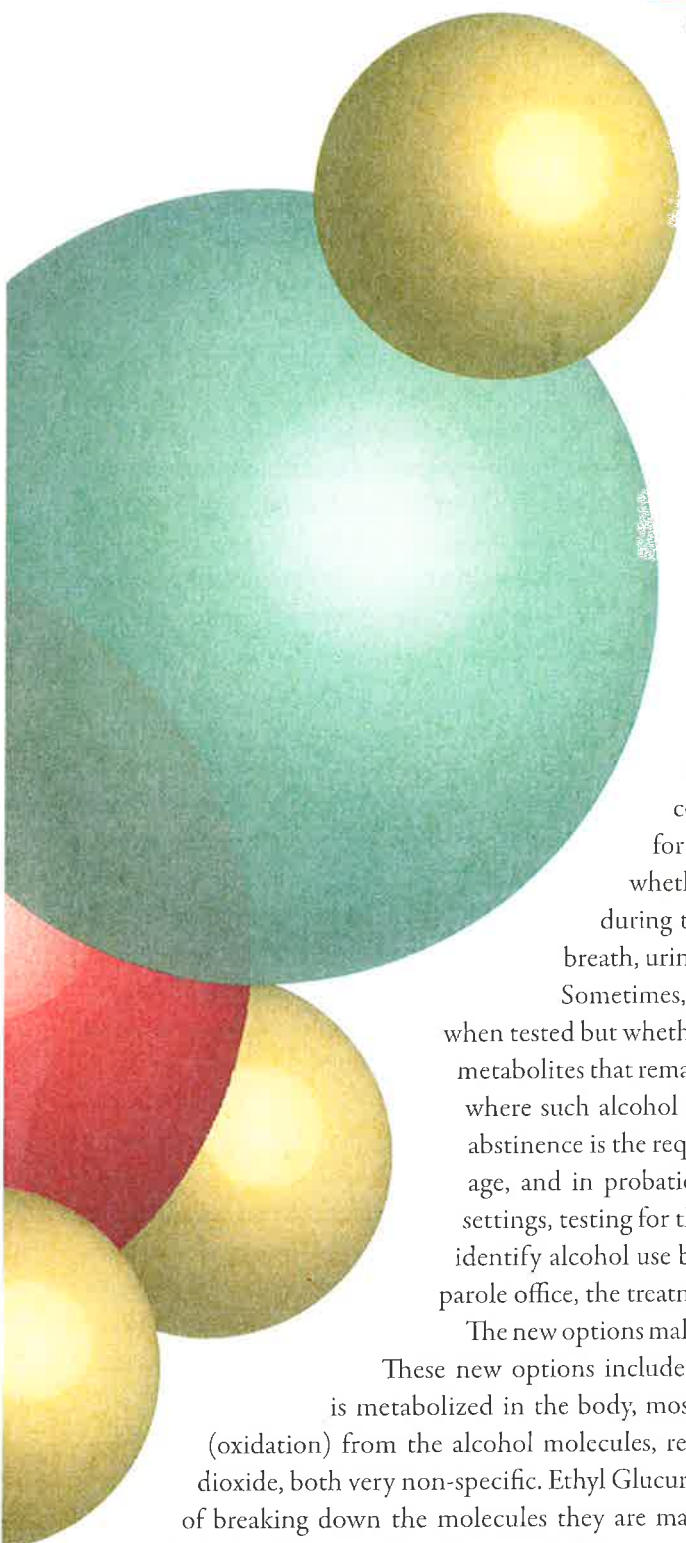


Drug testing is a powerful tool in the prevention, early intervention, treatment and the management of drug-related problems. Over the past 25 years, drug testing has dramatically increased in business and industry, the U.S. military, secondary schools, professional sports, addiction treatment programs, the criminal and juvenile justice systems and the child protection system. The Achilles' heel to the current system of drug testing has been that routine testing procedures until recently excluded the most widely used intoxicant in the United States:



ALCOHOL

TESTING FOR RECENT ALCOHOL USE



Monitoring individuals for recent alcohol use is hampered by the rapid metabolism of alcohol. Until recently, this has limited alcohol testing to a few hours after drinking stops. Several new developments are making it easier to test for alcohol use in the three to five days preceding the test by identifying the presence of alcohol metabolites (the by-products of the body's processing of alcohol). This is especially important in monitoring alcohol use in settings in which no alcohol use is permitted, e.g., alcoholism and drug abuse treatment, professional assistance programs, abstinence as a condition of probation or parole or child custody and for people under the legal drinking age. This article describes these new testing procedures and suggests ways they can be successfully integrated into a comprehensive probation-and parole-based alcohol and drug testing program. Because these tests for alcohol use are new, the practice guidelines are evolving rapidly. We describe the current best practices in the new testing procedures and we recommend checking with the providers of the tests that are used to keep up with future developments.

Most drug testing today uses urine samples. The most common drug test panel is the so-called "NIDA-5" used to identify the five drugs mandated in federal workplace testing guidelines: opiates (morphine/codeine), marijuana, cocaine, PCP, and amphetamine/methamphetamine. Unfortunately, this limited testing panel falls short of detecting many commonly used drugs and in detecting alcohol use. Of course, alcohol is a "legal" drug, but not for everyone. In the workplace where most workers are 21 or older, alcohol use outside of work is legal so the only question in that setting about alcohol is whether the worker is impaired by alcohol consumption at or just prior to work. For this purpose breath and saliva tests for alcohol levels are appropriate. Similarly, if there are questions regarding whether a child is intoxicated at school or in another setting or has been drinking during the preceding few hours, then testing for alcohol itself is appropriate using breath, urine or saliva.

Sometimes, however, the question is not whether the tested person is acutely intoxicated when tested but whether the person has used alcohol at all. Tests are now available to detect alcohol metabolites that remain in the body at measurable levels for up to five days after drinking. Examples where such alcohol testing is appropriate include drug and alcohol addiction treatment where abstinence is the requirement, school-based testing for students who are under the legal drinking age, and in probation and parole supervision where alcohol use may be prohibited. In these settings, testing for the presence of alcohol itself (the traditional test for alcohol) is a poor way to identify alcohol use because almost all drinking occurs hours before coming to the probation or parole office, the treatment program or the school.

The new options make alcohol testing practical in settings in which any alcohol use is unacceptable. These new options include ethyl glucuronide (EtG) and ethyl sulfate (EtS). Normally, when alcohol is metabolized in the body, most of the breakdown occurs by chemical systems that "take away" electrons (oxidation) from the alcohol molecules, resulting, for alcohol breakdown, in the final products of water and carbon dioxide, both very non-specific. Ethyl Glucuride and EtS, however, are formed by "non-oxidative" pathways where instead of breaking down the molecules they are made more complex by combining with larger molecules that deactivate the alcohol and thus render it "non-toxic." These non-oxidative metabolites, in the case of alcohol, EtS and EtG, are then slowly



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eliminated in the urine, making them excellent markers for recent drinking. These tests combined with on-site breath or saliva testing, which detect very recent drinking that can be done, for example, when a probation or parole officer (PPO) sees an offender in the field or at home, help cover the full spectrum of detection, both immediate and longer term. (Wurst, Skipper & Weinmann, 2003; Wurst, Vogel, Jachau, et al, 2003).

Additionally, new devices are being developed and studied that detect transdermal diffusion of alcohol (i.e. alcohol excreted through the skin). One such device, TruTouch, can be used in the probation or parole office to measure blood alcohol by placing the hand on the device. There are similar devices that can now be securely placed onto the ankle and worn continuously. Data from the device is downloaded to a monitoring station. Currently there are two commercially available mobile devices: SCRAM (Secure Continuous Remote Alcohol Monitor), and WristAS (Wrist Transdermal Alcohol Sensor). These devices measure alcohol passing from the blood through the skin and transmit data to the monitoring authority. These devices have been studied by the National Highway Traffic Safety Administration (NHTSA) and reports regarding validity are encouraging (Marques and McKnight, 2007). Drawbacks include cost at approximately five dollars per day and the discomfort of wearing a device continuously.

There are also remote electronic alcohol monitoring systems that combine random call schedules with a device that measures and transmits alcohol exposure through a voice-recognition, camera-equipped breathalyzer (e.g., products like the Sobriotor).

TESTS AVAILABLE FOR ALCOHOL – THE BIG PICTURE

When people use drugs, including alcohol and tobacco, the drugs are distributed throughout the body. The drugs and their metabolites are excreted in the urine and are present in sweat, saliva and growing hair. There are a few exceptions. For example, alcohol itself is not detectable in hair, but the metabolites, EtG and EtS can be detected in hair (Politti et al., 2006).

Oral fluids are tested by taking a sample of saliva from a person's mouth (by swab, dipstick or pipette). The window of detection of most drugs in oral fluids is from about 12 hours up to two to three days. Some drugs cannot yet be tested in saliva, including EtG and EtS at this time; however, saliva testing for the presence of alcohol is available and has approximately the same window of duration of detection as blood alcohol, usually a few hours after drinking stops.

TESTS FOR DIRECT DETECTION OF ALCOHOL

Blood Tests for Alcohol

Blood tests for alcohol can be obtained at laboratories, urgent care clinics and emergency rooms. A blood alcohol test is relatively cheap, about \$15, but requires a medical professional and often requires a physician evaluation and an additional physician or clinic fee. Policies governing blood tests vary by community and by laboratory. To obtain a blood test, it is necessary to transport the individual to the site and to draw blood. For these reasons, other types of alcohol tests are usually preferred.

Breathalyzer Testing

Breath tests for alcohol are easy to use, less invasive, less troublesome and – except for the initial cost of the breathalyzer equipment – much less expensive than blood tests. For breath testing the individual blows steadily and deeply into the breathalyzer. The reading is evident shortly after the device is triggered automatically following blowing a deep breath into the device. Some individuals attempt to cheat by feigning inability to blow deeply (the so called, "shy lung" syndrome). Only

someone with severe heart or lung disease would actually have trouble blowing adequately into a breathalyzer. It is easy to check that the breathalyzer is functioning by having someone else blow into the device to assure that it triggers a reading.

Testing breath for alcohol within a few hours of drinking will identify alcohol. However, after a few hours or more, the test will be negative because the alcohol will have dissipated. On-site breath tests for alcohol can be administered by PPOs in the office or in the field when alcohol use is suspected. They can also be administered by school officials at school parties and events and by parents at home. A breathalyzer adequate for occasional use can be purchased over the Internet for as little as \$50 (e.g. Alcohawk micro, or other similar devices), and more sophisticated, elaborate (sometimes with printout capability) are available for \$1,000 or more. Breathalyzers should be calibrated occasionally to maintain their accuracy. Manufacturers provide a method for calibration.

Saliva Testing for Alcohol

Saliva testing strips or kits for alcohol testing are readily available from drug treatment clinics, at some drug stores and over the Internet. Saliva alcohol levels correlate with blood and breath alcohol levels, however, they are less precise (being measured only at intervals such as .02, .04, .06, etc.). Oral fluid alcohol tests cost about \$3 per test and are available for purchase over the internet (e.g. Alcoscreen, Q.E.D. tests, and others).

Instructions are included with the tests and are easy to follow. Usually a test strip is placed under the tongue until wet and then is read after one minute. If there is a line on the strip, it is positive. Some strips have colors that are compared to a chart. Another saliva kit requires drawing some saliva from under the tongue using a small suction pipette supplied with the kit. A drop of saliva is then placed in a well on the test device and it absorbs onto the test area and the result is read.

Urine Testing for Alcohol

Since urine is collected in the bladder for a few hours until the next voiding, it may be positive for alcohol a few hours longer after drinking stops than the blood, breath or oral fluid alcohol tests. Urine alcohol testing is most often used if a urine sample is collected to be sent to a laboratory for other drug testing. An alcohol level can be requested and added to a drug test. Adding the alcohol test usually only adds a few dollars to the cost of the test. It has been found, however, that urine alcohol testing is largely inadequate to monitor abstinence in random testing programs because of the short duration of alcohol's pres-

ence in the urine following drinking. The concentration of alcohol in urine also does not correlate well with blood alcohol levels. Therefore, a urine test for alcohol can only be used qualitatively in order to document that alcohol is present and not quantitatively to document how much alcohol is in the body at the time of sample collection. Another caveat regarding alcohol found in urine is that alcohol can form in urine by fermentation during storage or shipment, particularly in diabetics, who can have glucose in their urine; therefore the presence of alcohol in urine is not necessarily proof of drinking. This however, does not always invalidate the test. (See next page).

TESTING FOR ALCOHOL METABOLITES THAT REMAIN IN THE BODY FOR SEVERAL DAYS


Alcohol Metabolism and the New Tests for Alcohol Use

When people use alcohol, it quickly finds its way into the bloodstream through absorption from the stomach and the intestines. The rapid circulation of the blood carries the alcohol to all parts of the body, where it is absorbed into tissue, including the lungs. The presence of alcohol in the body can be detected by testing breath, blood, saliva or urine for alcohol itself. Alcohol is rapidly metabolized by the liver and therefore leaves the body quickly at a constant rate. There is nothing that one can do to speed up or slow down this rate. This means that a person who tests positive for alcohol in breath, saliva or blood has consumed alcohol within the few hours immediately preceding the alcohol test. Because alcohol is metabolized fairly rapidly, alcohol itself is not usually detectable for more than six to eight hours following drinking.

EtG and EtS Testing

The alcohol people drink, ethyl alcohol also known as ethanol, is metabolized by the body through several pathways. One pathway metabolizes ethyl alcohol to ethyl glucuronide, EtG, and another to ethyl sulfate, EtS. Both of these metabolites remain in the body longer than alcohol itself. Depending upon the amount of alcohol consumed, EtG and/or EtS can be present in urine for up to almost a week after drinking stops. Testing urine for EtG or EtS has recently become popular with testing in health professional monitoring programs (Skipper, Weinmann, & Wurst, 2004) and in schools (Jones, 2007).

Ethyl Glucuronide and to a lesser degree EtS tests are now readily available through reference labs in the United States. EtG has been more widely used although more recent experience has suggested EtS may have significant advantages. The specific problems with EtG are that it can deteriorate in the urine over



time if bacteria are present (Helander & Dahl, 2005) and it has recently been reported that EtG also can be created in the urine if bacteria are present (Helander et al., 2007). Neither of these phenomena has been found to occur with EtS. Ideally, both tests should be performed at this time.

Hair testing for EtG and/or EtS has been perfected and will soon be commercially available. In one study, EtG concentrations in segments of hair were found to correlate well with the patient's detailed account of variations including an increase and decrease in alcohol consumption over preceding months (Appenzeller et al, 2007). Hair testing, however, is not as sensitive and will not detect moderate use of alcohol; therefore, a negative hair test does not prove abstinence. A positive hair test for EtG or EtS, on the other hand, proves significant use over the preceding weeks or months.

CUTOFFS

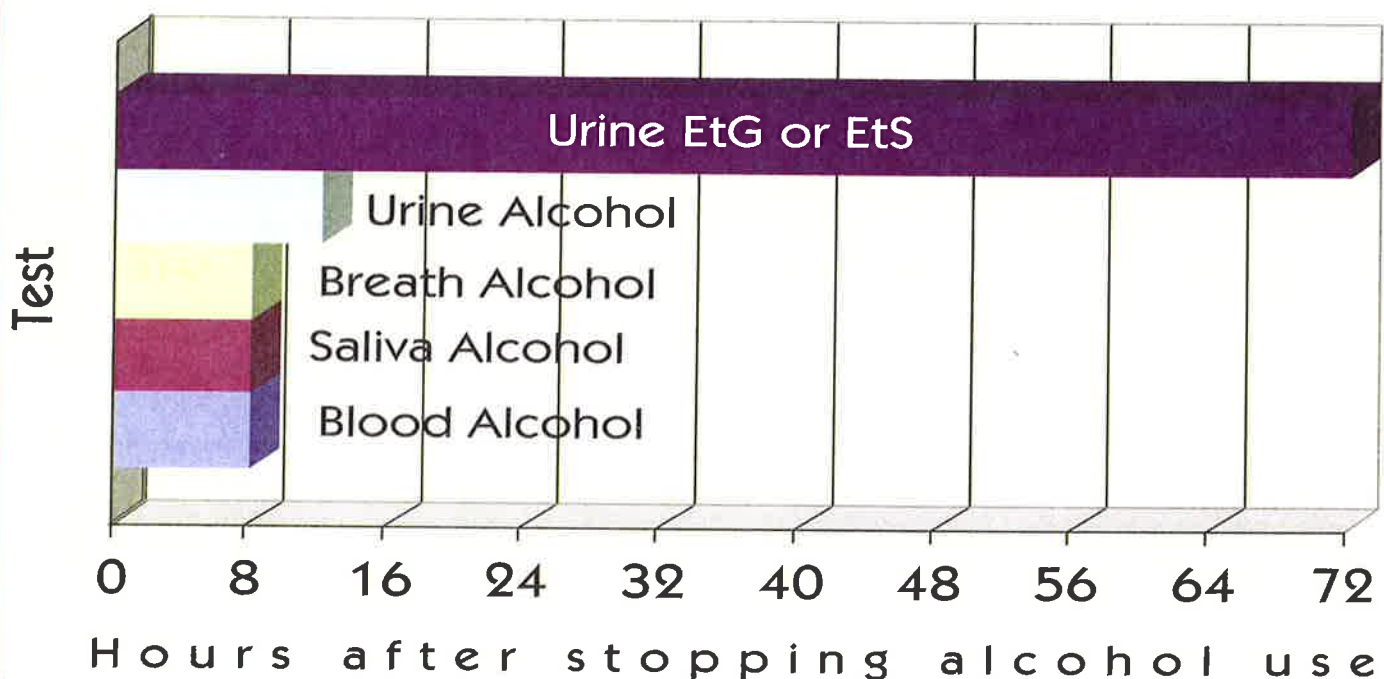
All drug tests have cutoff levels, below which the test result is reported as negative. Cut-off levels are chosen to protect against "false positives" which can occur at levels below the specificity of the method of testing and from incidental or innocent exposure to the tested substances. For alcohol testing "innocent exposure" can be the result of recent exposure to alcohol from products

such as mouthwash, foods, over-the-counter medicines or even from frequent exposure to the vapor of ethanol -- hand gels, bug spray, or other.

For alcohol, EtG and EtS cutoffs have become controversial because of the large number of widely used products that contain alcohol. Commonly used EtG cutoffs range between 100ng/ml and 1,000ng/ml and EtS between 25ng/ml and 100ng/ml. High cut-offs reduce the problem of "innocent exposure" but they do this at the cost of failing to identify relatively lower levels of alcohol consumption and/or alcohol consumption at relatively more distant times. Low cut-offs identify alcohol use at lower levels and for longer periods of time, but they also identify more "innocent exposure" to alcohol-containing products. Because EtG and EtS testing are relatively new, the cut-off levels are evolving with increasing experience and increasing research. In this paper we offer suggestions for handling these problems, but when questions arise about the interpretation of a particular result it is useful to review the results with a Medical Review Officers (MRO) and to discuss the results with the laboratory that did the test (See Below).

When monitoring someone for alcohol use with EtG or EtS testing, it is important that the individual being tested agree to avoid use of products associated with incidental alcohol

Figure 1: Duration of Detection of Alcohol Use



ALCOHOL...and the offender

exposure. Low levels of EtG or EtS in urine are sometimes difficult to interpret if the person denies drinking. Therefore it is important to initially approach the individual in ways that promote candor and honesty. There is no cutoff level that reliably distinguishes between incidental exposure to alcohol and drinking beverage alcohol because ethyl alcohol is the same in both of these exposures. A low level EtG/EtS can be from drinking alcohol several days ago or from incidental exposure more recently.

There are no “quick tests” for on-site testing to identify EtG or EtS in urine at this time. The urine sample must be collected and then sent to a laboratory for analysis, a process that typically takes a several days or more. Ethyl Glucuronide or EtS testing can cost from \$15 to \$75 depending on the lab. A new screening test has recently been perfected that allows automated testing in the lab using an immunoassay (i.e. test using antibodies) that promises to be less expensive (Bottcher et al, 2008).

DEALING WITH POSITIVE ETG/ETS OR URINE ALCOHOL RESULTS

Testing for alcohol and drugs should be done after the subject has been informed in advance that the testing will be performed, after the tested person has been warned not to use alcohol-containing products, and when there is a clear understanding of the consequences to be imposed as a result of a positive test. In probation and parole, this is done at the outset of supervision when the conditions are explained and signed. The primary purpose of alcohol and drug testing is not to catch the offender; it is to prevent the use of alcohol and other drugs. This deterrent effect is best achieved by calm, thoughtful discussion of the testing and a clear understanding of the purposes of the testing. In probation or parole-based alcohol and drug testing the agency needs to have a well-understood policy about alcohol and drug use by the offenders and a strategy to deal with any problems that emerge in the testing. Disputes about the interpretation of a positive alcohol or drug test can be resolved by an

Figure 2: Comparison of various alcohol markers

Test	Detection time*	Benefits	Drawbacks	Cost
Breathalyzer	Two to eight hours depending on drinking behavior	Ease of use, low cost, readily available	Alcohol vapor (from hand gel, etc) can cause false positive test	10 cents per test, device - \$50-1,000
Blood alcohol	Two to eight hours depending on drinking behavior	“Gold standard,” best evidence for court proceedings	Prescription or doctor’s order needed to obtain test	\$15-25
Saliva alcohol	Two to eight hours depending on drinking behavior	Easier to obtain sample compared to urine, ease of use of new quick alcohol tests	Quick tests on saliva not as accurate as blood alcohol	\$0.50 - 3
Urine alcohol	Three to Twelve hours	Urine often obtained to test for other drugs and alcohol tests can be added	Cannot be used for quantization	\$2-15
EtG/EtS	One to six days	Longer detection time, can confirm fermentation as the cause for positive urine alcohol	Very sensitive (false positives from “incidental exposure” to environmental alcohol, cost	\$15-75
SCRAM device	Continuous monitor thus detection time unlimited	Continuous monitoring, “longest detection time”	Cost, discomfort of wearing device	\$5/day



MRO. Local laboratories doing alcohol and drug tests can refer PPOs to local MROs.

In September of 2006, the Substance Abuse and Mental Health Services Administration issued an advisory regarding alcohol biomarkers (SAMHSA, 2006). This advisory warned against over-reliance on positive EtG or EtS results as the sole indicator of alcohol use, especially if drastic actions (e.g., termination from a job, incarceration, etc) are being considered as a response to a positive test. The advisory points out that no cutoff level can be relied on to always distinguish between incidental exposure to ethanol and alcohol beverage consumption. Nevertheless EtG and EtS continue to reliably document abstinence and they are useful for the detection of drinking alcohol. Confronted with a positive EtG or EtS test result many individuals admit to drinking. Additionally, a positive test, even if drinking is denied, indicates a higher likelihood of drinking. In response, surveillance can be increased. In difficult cases other procedures can be helpful in deciding if a positive EtG or EtS truly indicate drinking. These procedures can include: polygraphy, hair EtG or EtS testing, having the individual use the source of incidental exposure claimed to be causing the positive (e.g. hand gel) and retesting for EtG or EtS to see if it causes a positive test. If problems emerge with the alcohol and drug testing, contact the laboratory that performed the test and/or reach out to local experts in alcohol and drug abuse prevention and treatment for guidance and support. Alcohol and drug testing is usually done without significant problems in interpretation but when problems do occur, it is important to obtain help.

Positive test results for recent alcohol use, even if questionable (for example, a low positive EtG or EtS test, or a positive urine alcohol test) should be treated initially as proof of drinking alcohol since this is usually the case. The individual who tests positive should be approached in a calm, supportive manner with assurance that the test identified recent drinking. Most individuals who have been drinking or using drugs know that they run the risk of being detected if they are asked to submit a urine sample. In fact, they actually suspect and dread the positive result.

If alcohol use is strongly and insistently denied, particularly if the test report was a urine alcohol or low positive (i.e. less than 1,500 ng/ml) EtG or EtS test, then it can be acceptable to consider that the initial positive result could be "false positive" due to in-vitro fermentation or incidental alcohol exposure. Continued frequent urine testing for EtG and/or EtS, with warning that continued positive tests, no matter what the source of exposure to

any alcohol-containing product, will be interpreted as a positive test. The EtG/EtS tests will not usually remain borderline for long in the presence of continued drinking.

Communication of test results is best followed by informing the individual involved of the consequences of the positive alcohol or drug test—consequences that may include the necessity of professional screening or assessment, counseling services or treatment and ultimately legal consequences. Ultimately, it is hoped the alcohol and drug testing that serves as a deterrent to use and a catalyst for problem identification and intervention can also serve as a tool of recovery support in probation and parole supervision, drug court programs and in professional treatment settings.

Readers may find two additional resources helpful: *Guide to Responsible Family Drug Testing and Alcohol Testing* and *Smarter Student Drug Testing* (DuPont & Bucher, 2005; DuPont & Graves, 2005). Both are available on the website of the Institute for Behavior and Health, Inc. (www.ibhinc.org) and include information applicable to the probation and parole settings. These papers also discuss the role of the Medical Review Officer in the interpretation of test results.

SUMMARY

The availability of EtG and EtS testing in urine samples provides a valuable new opportunity to prevent alcohol use, and when appropriate, to intervene in settings in which any use of alcohol is prohibited. Because this testing is new, it is important for frontline service specialists to understand how it works and how to interpret test results. ▲

REFERENCES

- Appenzeller BM, Agirman R, Neuberger P, Yegles M, Wennig R. "Segmental determination of ethyl glucuronide in hair: a pilot study." *Forensic Sci Int*. 2007 Dec 20;173(2-3):87-92
- Böttcher M, Beck O, Helander A. "Evaluation of a new immunoassay for urinary ethyl glucuronide testing." *Alcohol Alcohol*. 2008 Jan-Feb;43(1):46-8
- DuPont, R.L., & Bucher, R.H. (2005). Guide to responsible family drug testing and alcohol testing. Retrieved from www.ibhinc.org/articles/familyguidetodrugtesting.pdf.
- DuPont, R.L., & Graves, H. (2005). Smarter student drug testing. Retrieved from www.ibhinc.org/articles/SmarterRSDT.pdf.
- DuPont, R. L., Goldberger, B. A. & Gold, M. S. (2008 - In Press). "Drug testing in addiction medicine." In R. K. Ries, D. Fiellin, S. C. Miller & R. Saitz (Eds.) *Principals of Addiction Medicine* (4th ed.). Chevy Chase, MD: American Society of Addiction Medicine.
- DuPont, R. L. & Brady L.A. (2005). "Drug testing in schools: Guidelines for effective use." Center City, MN: Hazelden.
- DuPont, R. L. (2000). "The Selfish Brain: Learning from addiction." (*Revised and updated*). Center City, MN: Hazelden.
- Helander, A., & Dahl, H. (2005). "Urinary tract infection: A risk factor for false-negative urinary ethyl glucuronide but not ethyl sulfate in the detection of recent alcohol consumption." *Clinical Chemistry*, 51(9), 1728-1730.
- Helander, A., Olsson, I., & Dahl, H. (2007). "Postcollection synthesis of ethyl glucuronide by bacteria in urine may cause false identification of alcohol consumption." *Clinical Chemistry*, 53, (10), 1.

Jones, C. (2007). Schools' test can detect alcohol use 3 days prior. *USA Today*, March 3, 2007

Marques P.R. and McKnight A.S. Evaluating Transdermal Alcohol Measuring Devices. Nov 2007. Published by NHTSA, www.nhtsa.gov, and available on the internet at: www.nhtsa.dot.gov/portal/nhtsa_static_file_downloader.jsp?file=/staticfiles/DOT/NHTSA/Traffic%20Injury%20Control/Articles/Associated%20Files/810875.pdf

Politi, L., Morini, L., Leone, F., & Polettoni, A. (2006). Ethyl glucuronide in hair: Is it a reliable marker of chronic high levels of alcohol consumption? *Addiction*, 101(10), 1408-1412.

SAMHSA (2006). http://www.kap.samhsa.gov/products/manuals/advisory/pdfs/0609_biomarkers.pdf

Skipper G.E., Weinmann W., & Wurst, F.M. (2004). Ethylglucuronide (EtG): A new marker to detect alcohol use in recovering physicians. *Journal of Medical Licensure and Discipline*, 90(2), 14-17

Wurst, F.M., Skipper, G.E., & Weinmann, W. (2003). Ethyl glucuronide- the direct ethanol metabolite on the threshold from science to routine use. *Addiction*, 98(Suppl 2), 51-61.

Wurst, F.M., Vogel, R., Jachau, K., Varga, A., Alling, C., Skipper, G.E., & Alt, A. (2003). Ethyl glucuronide detects recent alcohol use in forensic psychiatric inpatients. *Alcoholism: Clinical and Experimental Research*, 27, 471-476.

ADDITIONAL RESOURCES

Information regarding EtG Testing
www.ethylglucuronide.com

State List of Certified Labs
<http://workplace.samhsa.gov/ResourceCenter/lablist.htm>

American Society of Addiction Medicine (ASAM) List of Medical Review Officers
www.asam.org/search/search4.html

American Association of Medical Review Officers Registry
www.aamro.com/registry_search.html

Substance Abuse Treatment Facility Locator
www.findtreatment.samhsa.gov



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