

DRUG TESTING AND EVIDENCE IN CHILD WELFARE

Darice M. Good, JD, CWLS

Good Legal Firm, LLC

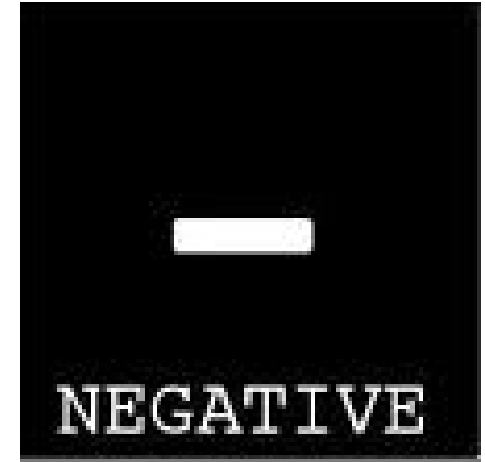
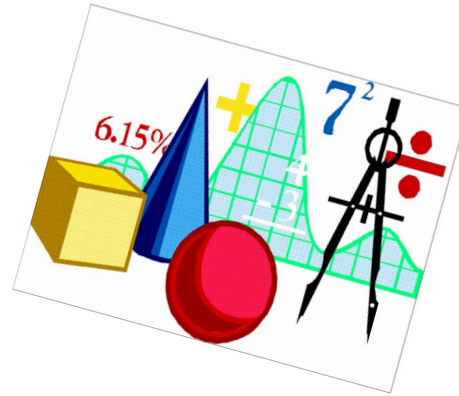
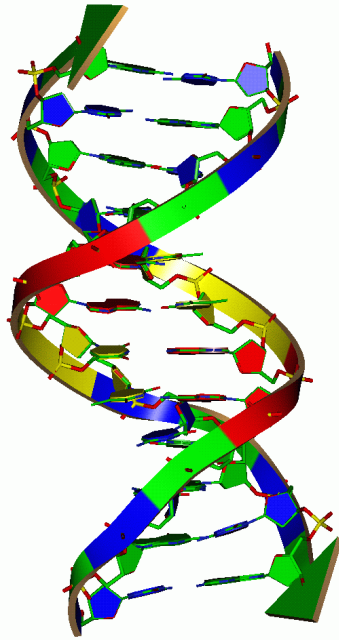
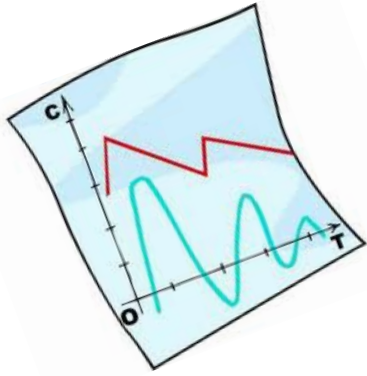
Diana Rugh Johnson, JD, CWLS

Georgia Court Improvement Program

ROADMAP

- Resources
- How drug tests work
- Types of drug tests
- Chain of custody
- Examination





INFORMATION IS ONLY USEFUL WHEN IT
CAN BE UNDERSTOOD



SOMETIMES
GOOGLE FAILS
TO DELIVER





Google Scholar



National Center on
Substance Abuse
and Child Welfare



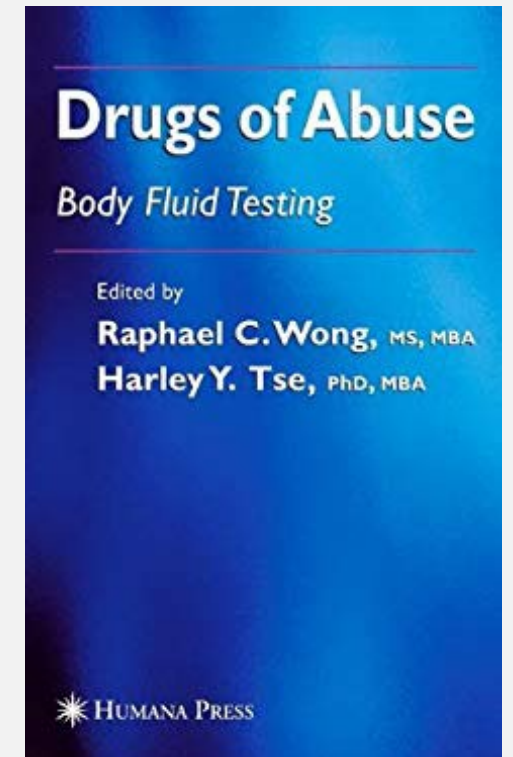
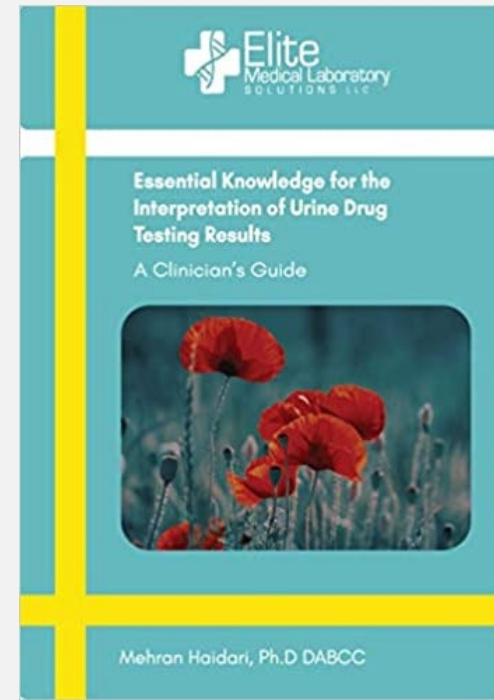
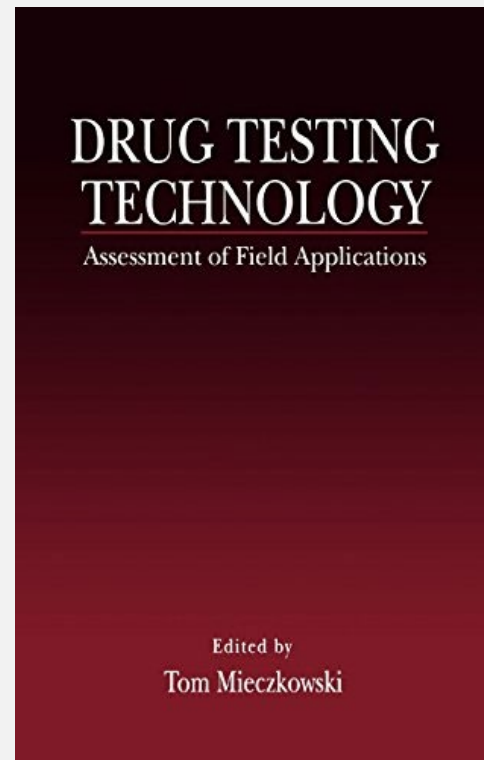
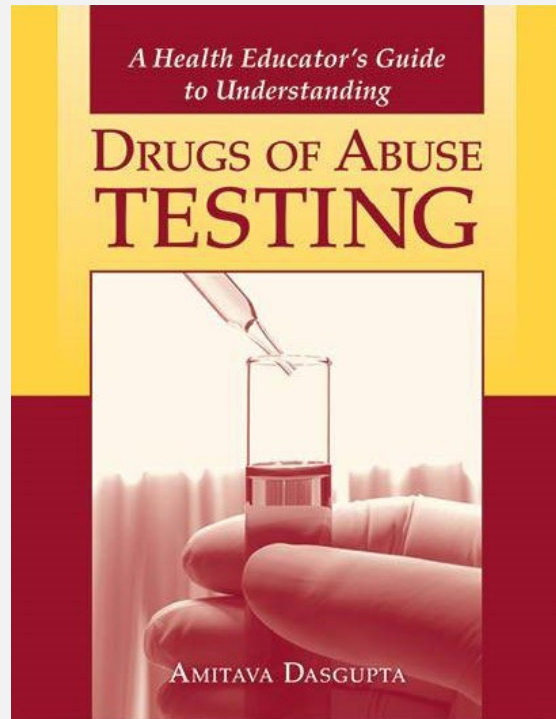
NADCP
National Association of
Drug Court Professionals

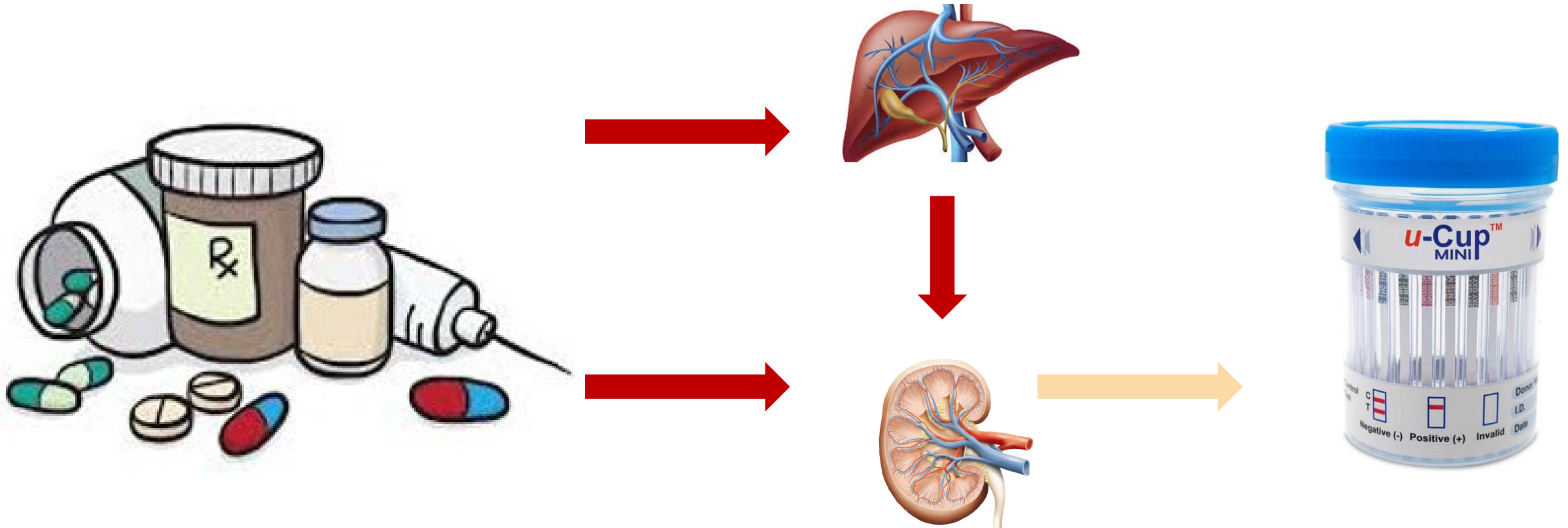


NDCI
NATIONAL DRUG
COURT INSTITUTE

RELIABLE ON-LINE RESOURCES

BOOKS



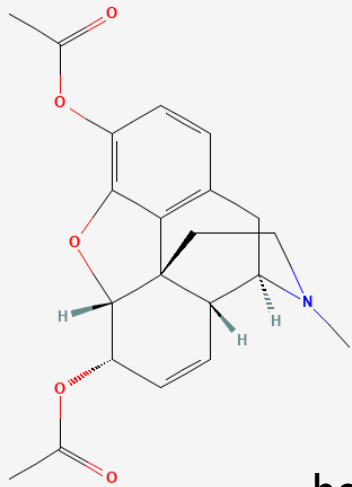


WHAT DO DRUG TESTS DETECT?

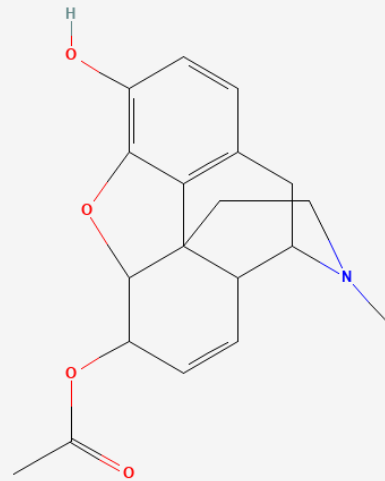
DRUGS AND DRUG METABOLITES*

*substances formed when the body breaks down drugs

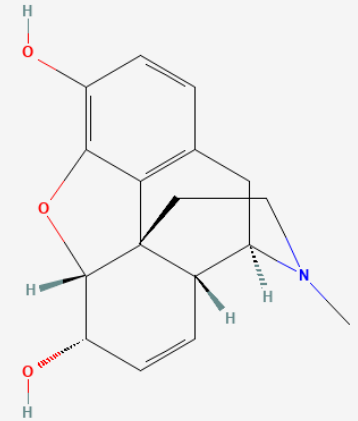
AN EXAMPLE OF DRUG METABOLITES



heroin



6-monoacetylmorphine



morphine

pseudocholinesterase

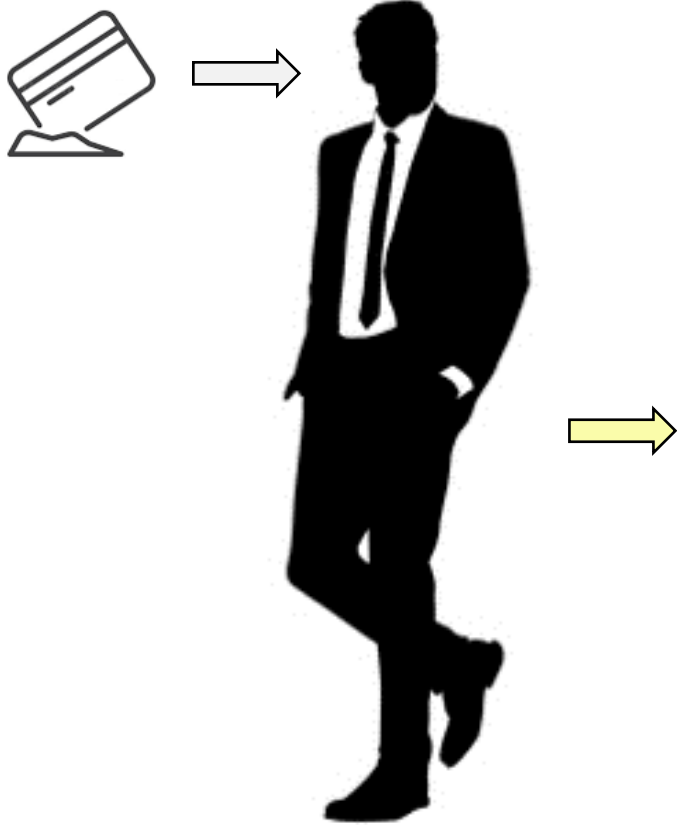


deacetylation

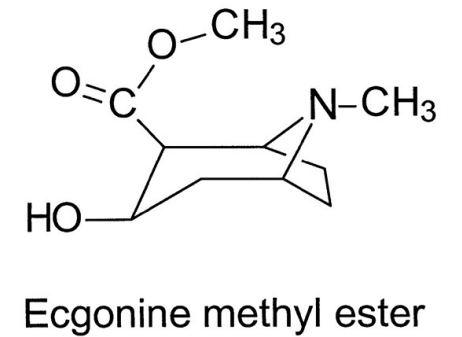
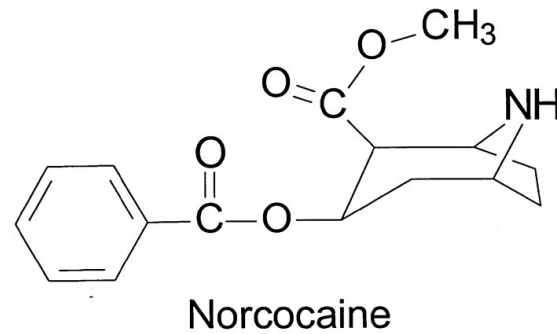
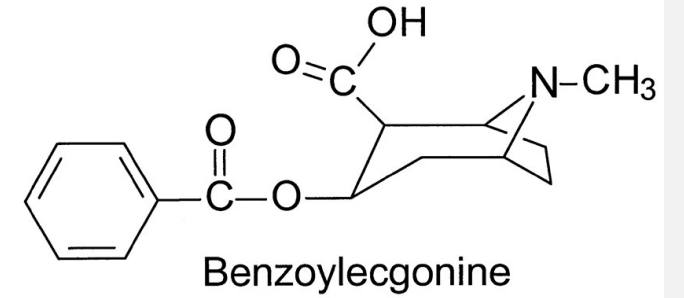
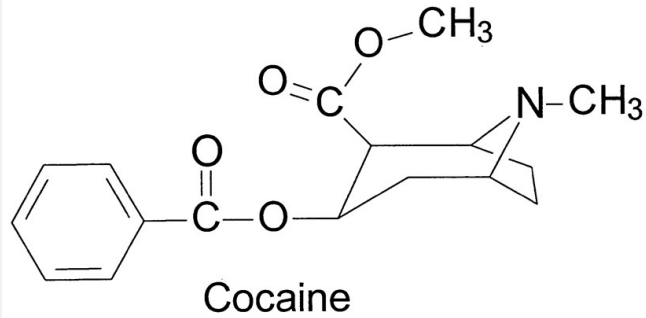
pseudocholinesterase



deacetylation



COCAINE METABOLISM

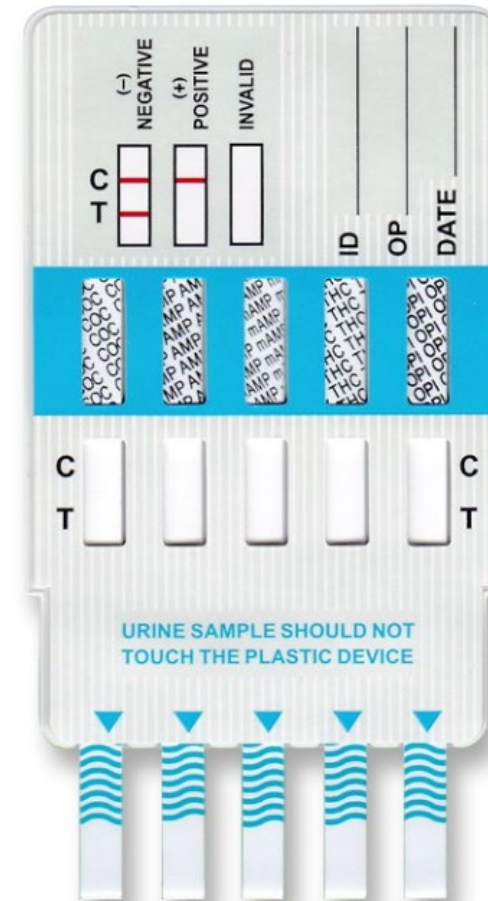


CHEMISTRY LESSON I

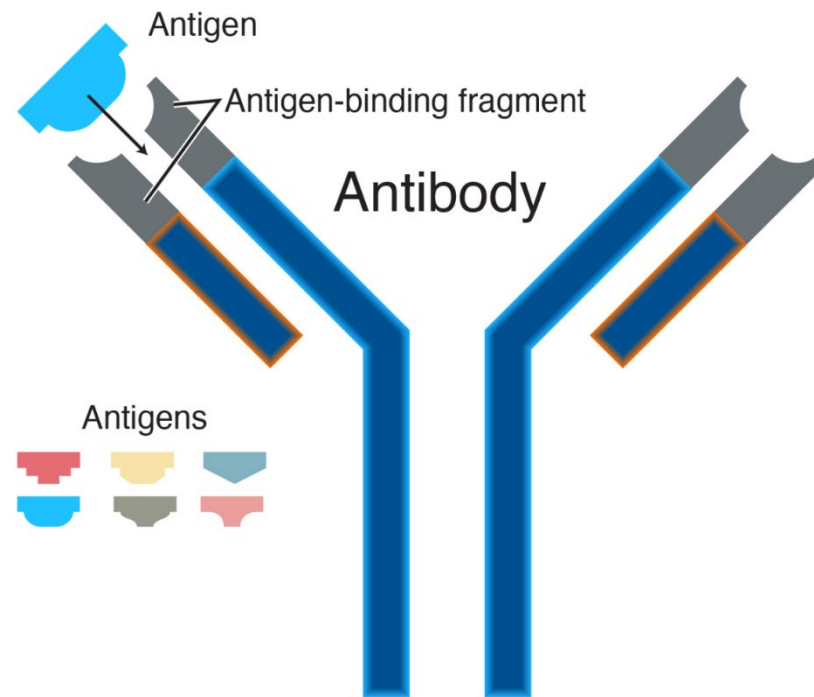
POINT OF CARE URINE SCREENS ARE
NOT RELIABLE EVIDENCE OF DRUG USE

POINT OF CARE TESTS

- Lateral flow immunochromatographic assays
- Drug metabolites are recognized and bound by specific antibodies
- Chemical reaction → color change



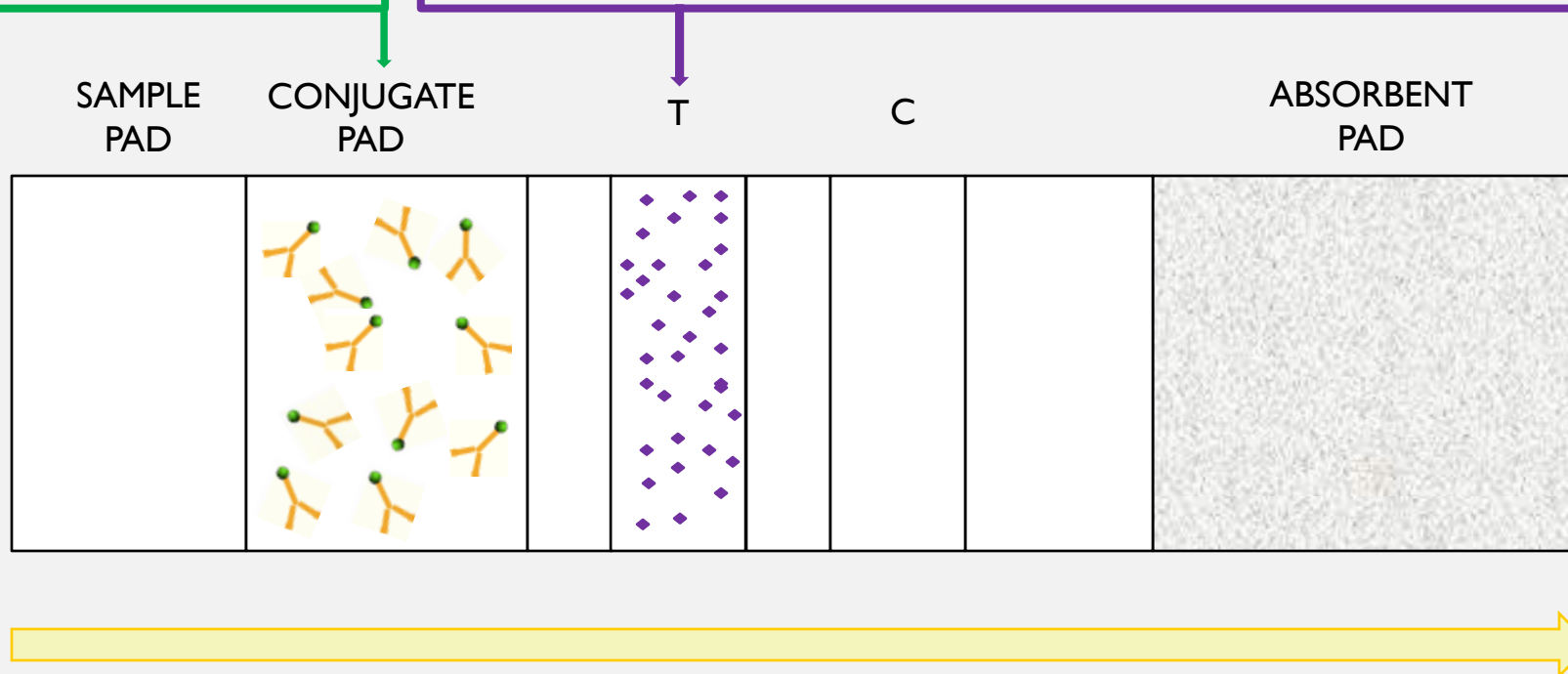
HOW ANTIBODIES WORK



HOW POINT OF CARE DRUG TESTS WORK

COATED WITH COLORED, COLLOIDAL GOLD NANOPARTICLES THAT ARE CONJUGATED WITH ANTIBODIES

CONTAINS DRUG CONJUGATES THAT ARE STRUCTURALLY SIMILAR TO THE PORTIONS OF THE DRUG METABOLITE THAT THE ANTIBODIES WILL RECOGNIZE



SAMPLE DOES NOT CONTAIN DRUG METABOLITES

Figure 1

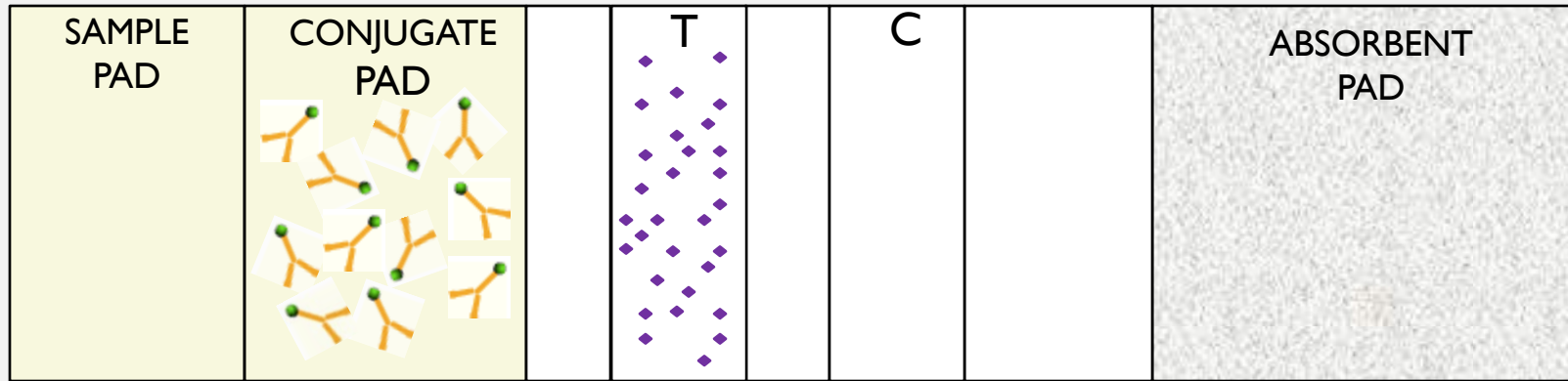


Figure 2

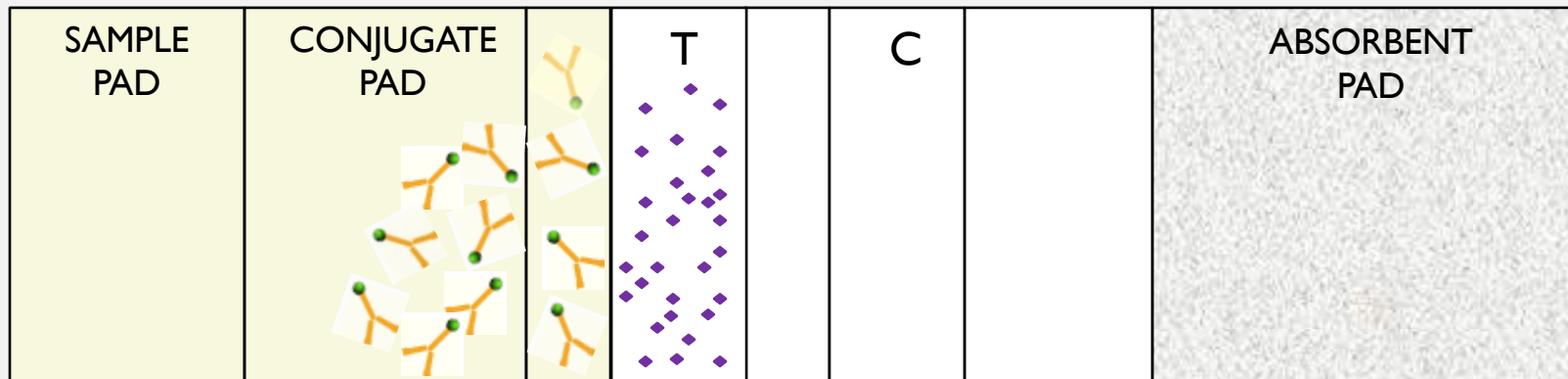


Figure 3

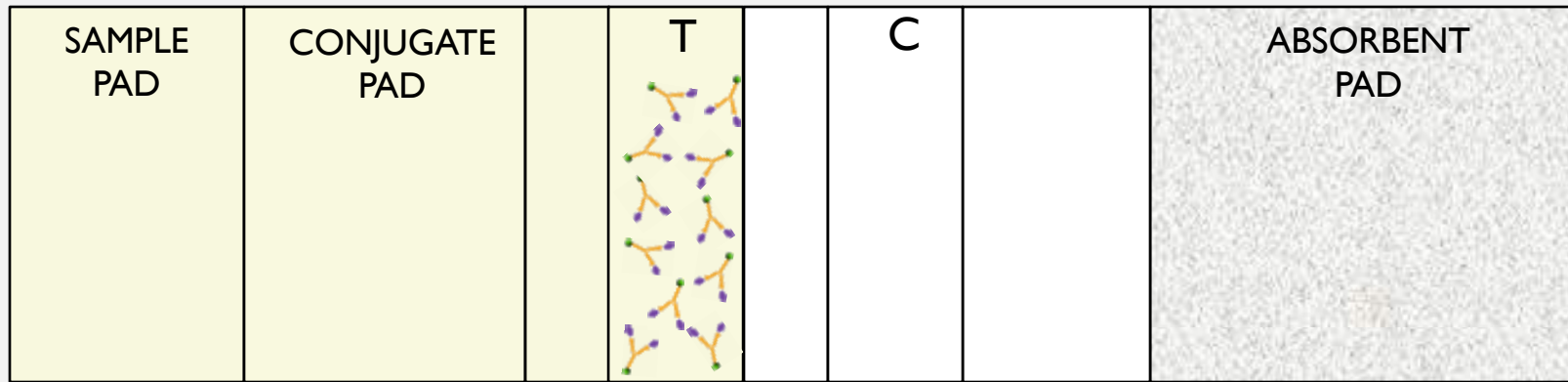


Figure 4

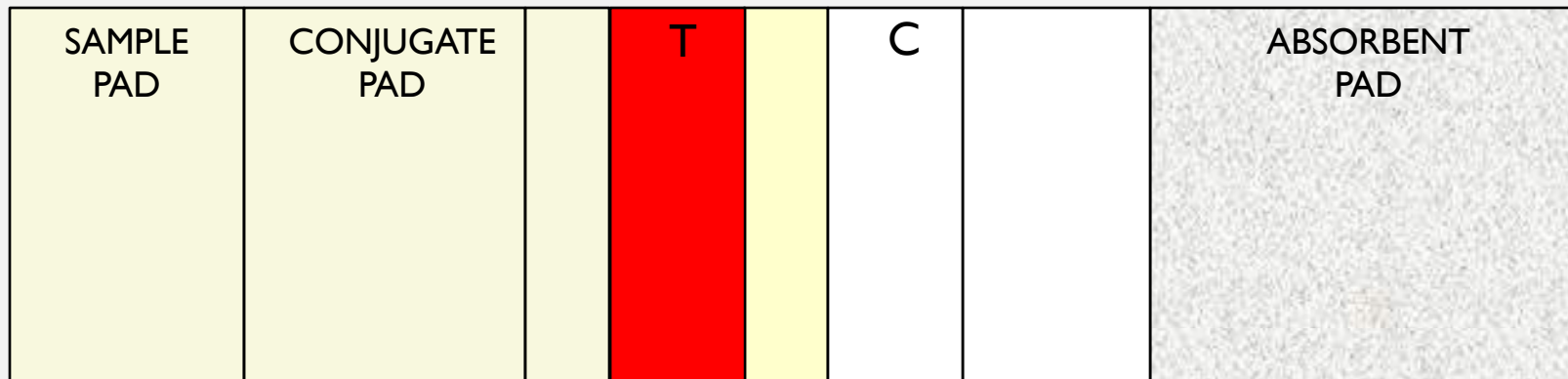
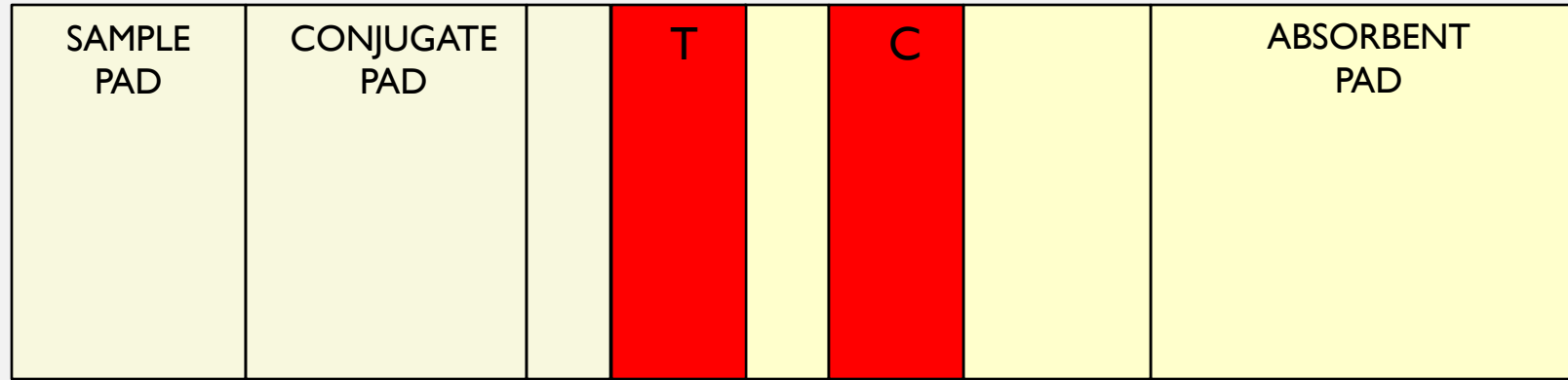


Figure 5



SAMPLE CONTAINS DRUG METABOLITES

Figure 6

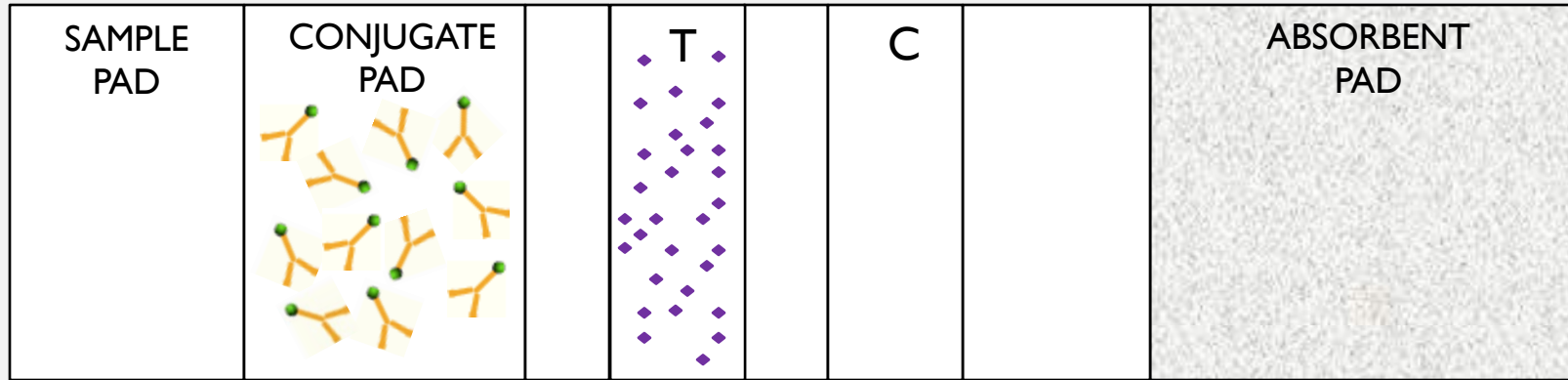


Figure 7

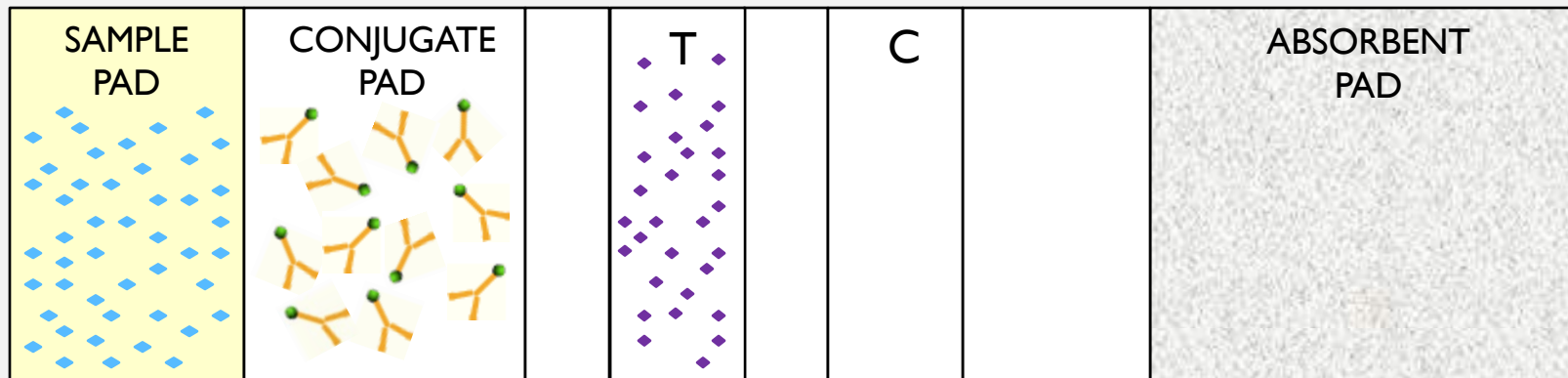


Figure 8

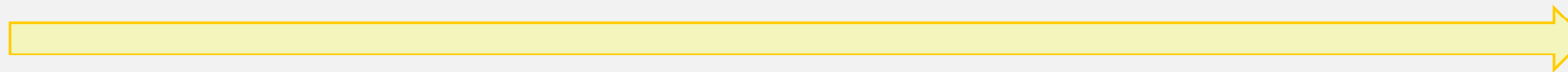
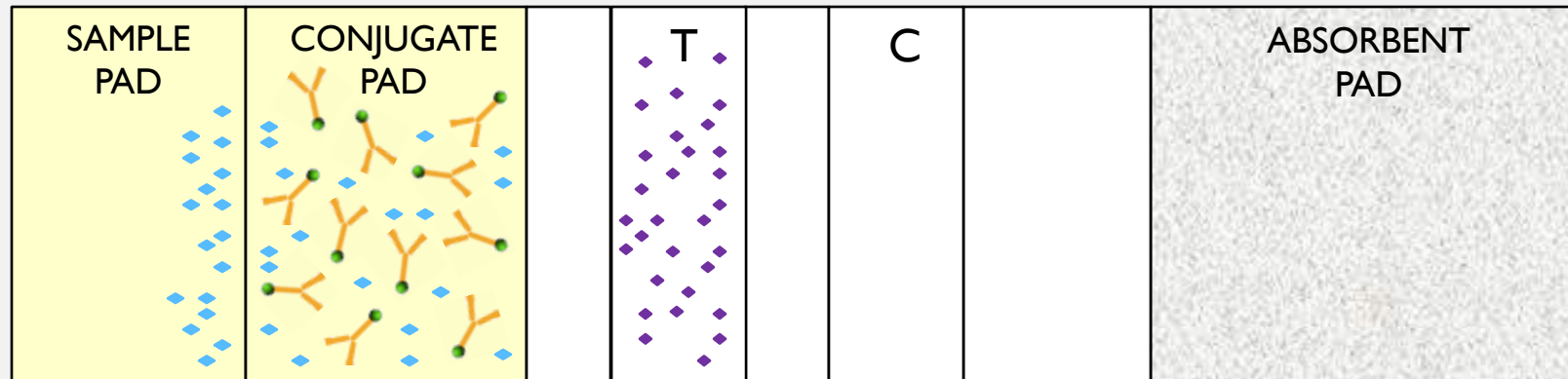


Figure 9

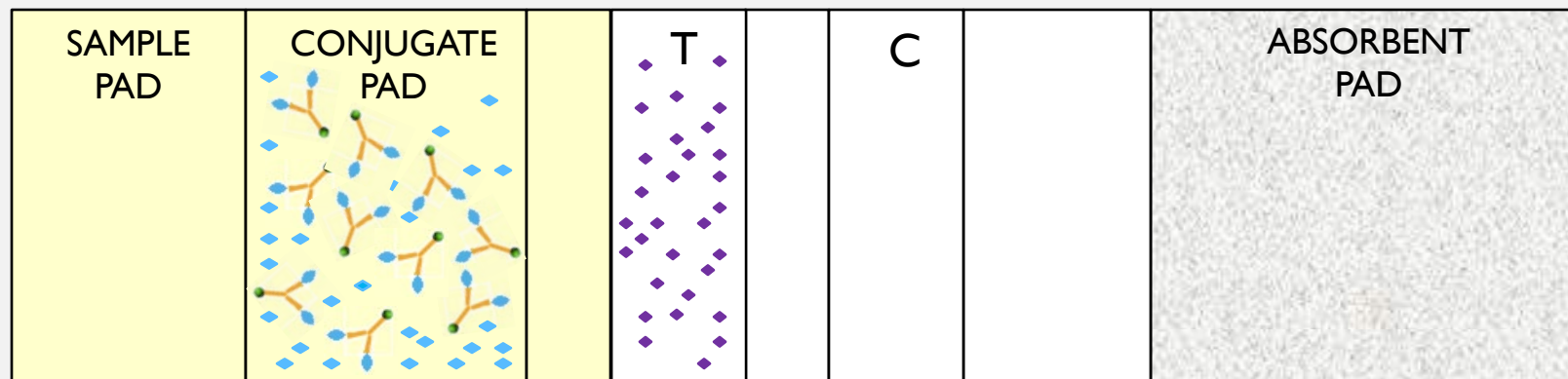


Figure 10

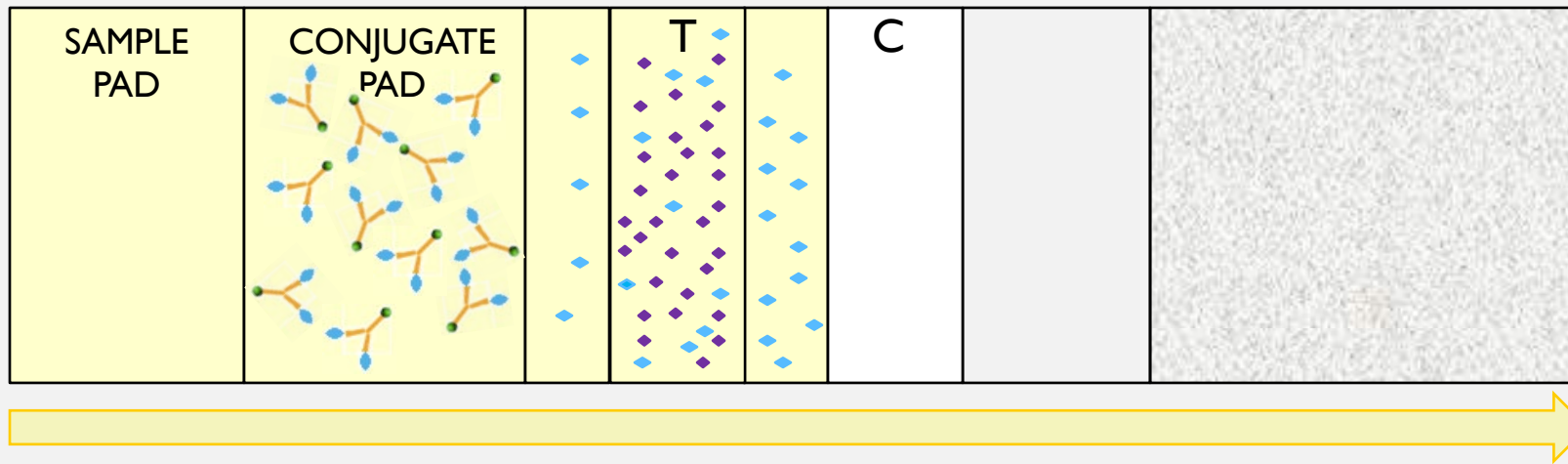
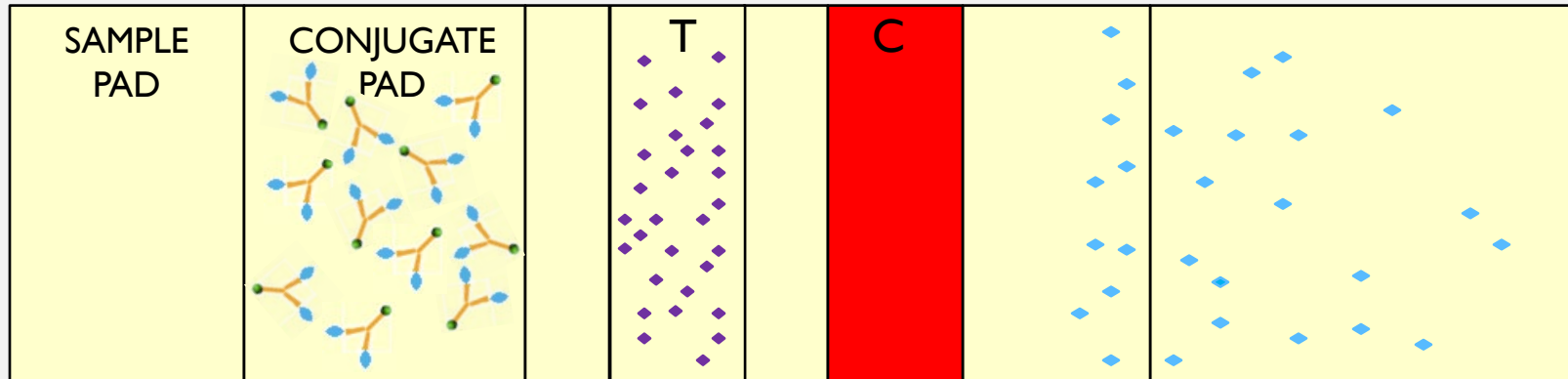


Figure 11



HOW RELIABLE ARE THE RESULTS OF POINT OF CARE URINE SCREENS?

The answer is in the package insert!





One Step Multi-Drug Test Dip card CLIA Waived Package Insert

This assay provides only a preliminary analytical test result. A more specific alternate chemical method must be used in order to obtain a confirmed analytical result. Gas chromatography/mass spectrometry (GC/MS) is the preferred confirmatory method. Clinical consideration and professional judgment should be applied to any drug of abuse test result, particularly when preliminary positive results are used.



Multi-Drug Urine Test Cup Package Insert (CLIA Waived)

The test is intended for use as the first step to provide health care professionals and consumers with information concerning the presence or absence of the above stated drugs in a urine sample.

LIMITATIONS OF POINT OF CARE TESTS

- High concentration cut-offs
- Relatively short detection windows
- Qualitative, not quantitative
- Antibody cross-reactivity with legal medications



TYPICAL WINDOWS OF DETECTION

DRUG	DETECTION WINDOW
Alcohol	7-12 hours
Amphetamine	2-3 days
Benzodiazepines	2 days – short acting 5 days – intermediate acting 10-30 days – long acting
Cocaine	2 days after single use 4 days after repeated use
Morphine	2-3 days
Methadone	3-5 days
Oxycodone	2-4 days
Codeine	2 days
Heroin	2 days
Phencyclidine	14 days
Marijuana	2-3 days after single use 30 days in chronic abuser

CHEMISTRY LESSON 2

THERE IS NO SUCH THINGS AS
A FAINT POSITIVE

WHAT IF THE COLOR CHANGE AT THE TEST LINE IS FAINT?

INTERPRETATION OF RESULTS

(Please refer to the illustration above)

NEGATIVE:* Two lines appear. One red line should be in the control region (C), and another apparent red or pink line adjacent should be in the test region (Drug/T). This negative result indicates that the drug concentration is below the detectable level.

***NOTE:** The shade of red in the test line region (Drug/T) will vary, but it should be considered negative whenever there is even a faint pink line.

POSITIVE: One red line appears in the control region (C). No line appears in the test region (Drug/T). This positive result indicates that the drug concentration is above the detectable level.

INVALID: Control line fails to appear. Insufficient specimen volume or incorrect procedural techniques are the most likely reasons for control line failure. Review the procedure and repeat the test using a new test panel. If the problem persists, discontinue using the lot immediately and contact your manufacturer.

Note: There is no meaning attributed to line color intensity or width.

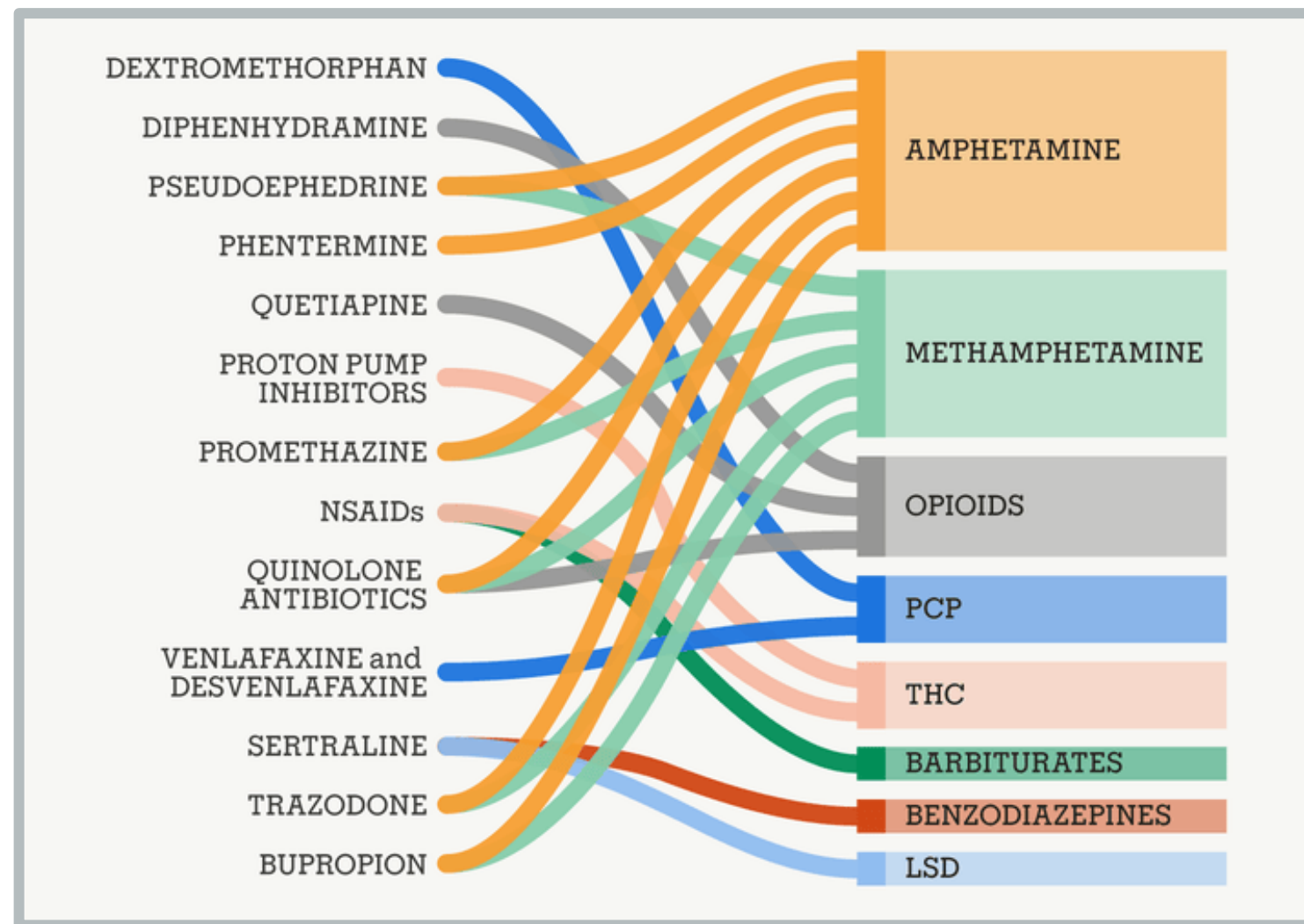
A preliminary positive test result does not always mean a person took illegal drugs and a negative test result does not always mean a person did not take illegal drugs. There are a number of factors that influence the reliability of drug tests. Certain drugs of abuse tests are more accurate than others.

IMPORTANT: The result you obtained is called preliminary for a reason. The sample must be tested by laboratory in order to determine if a drug of abuse is actually present. Send any sample which does not give a negative result to a laboratory for further testing.

CHEMISTRY LESSON 3

LAB TESTS ARE MORE RELIABLE THAN
POINT OF CARE TESTS

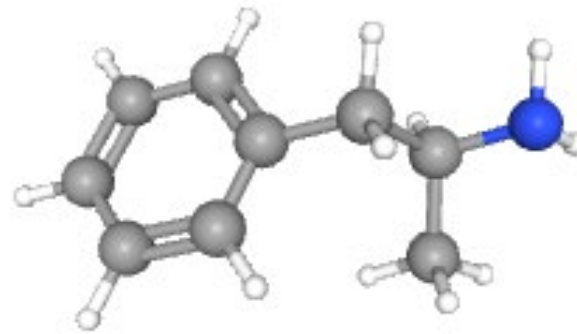
COMMON PRODUCTS THAT INTERFERE WITH IMMUNOASSAYS



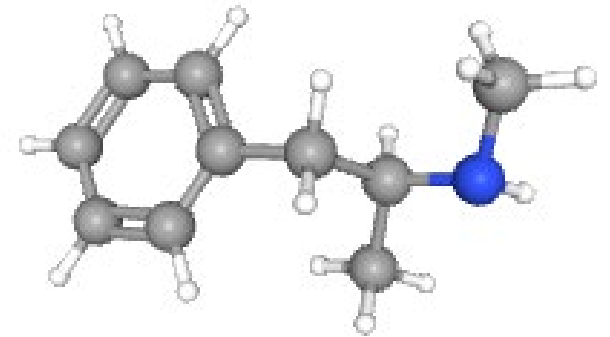
COMMON PRODUCTS
THAT INTERFERE WITH
AMPHETAMINE AND
METHAMPHETAMINE
IMMUNOASSAYS

CLASS OF DRUG	INTERFERING COMPOUND	PRODUCT NAMES
Antihistamine	Brompheniramine	Allent, Andehist syrup, Bromadrine PD, Bromofed-DMDallergy, Demetapp
Diet Pill	Ephedra (ephedrine) Phentermine Tyramine	Fastin, Adipex
Decongestant	Phenylpropanolamine Pseudoephedrine Phenylephrine	Actifed, Alka-Seltzer Plus, Allegra-D, Claritin D, Comtrex Daytime, Tylenol, Tylenol Sinus, Vicks 44
Acid reducer	Ranitidine	Zantac

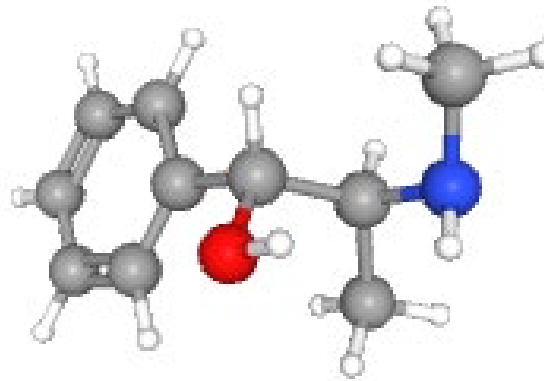
LOOK AT THE
SIMILARTIES



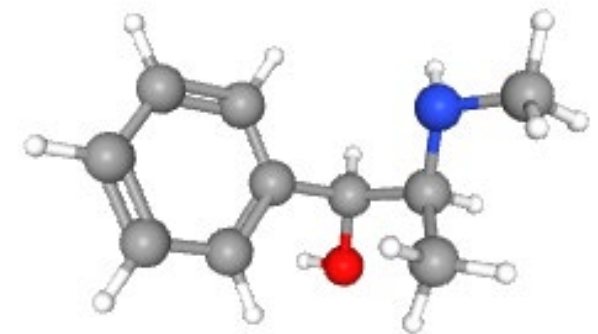
amphetamine



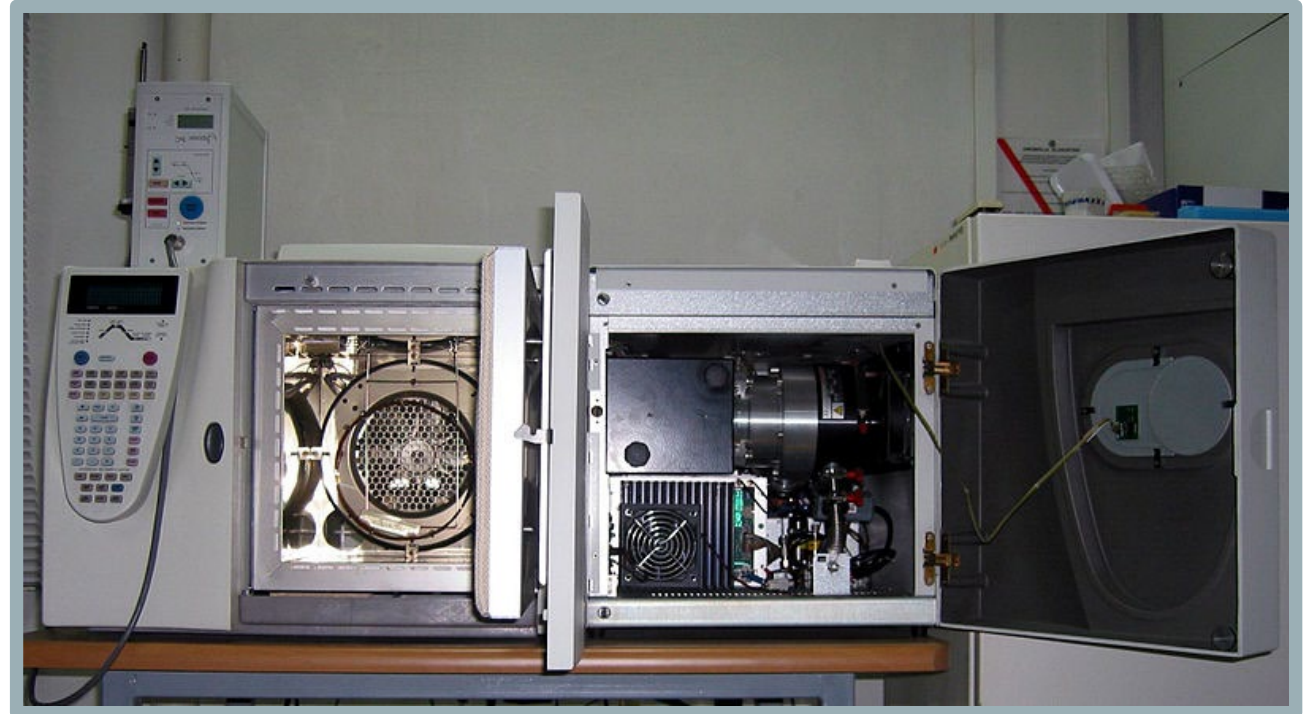
methamphetamine



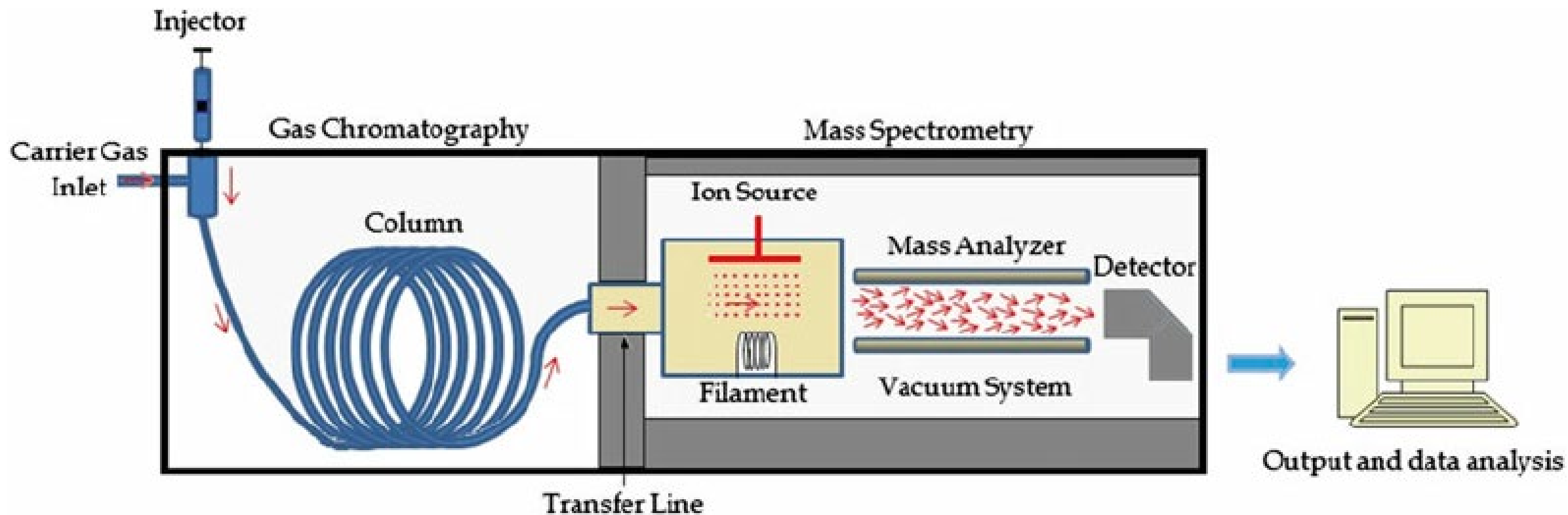
ephedrine



pseudoephedrine

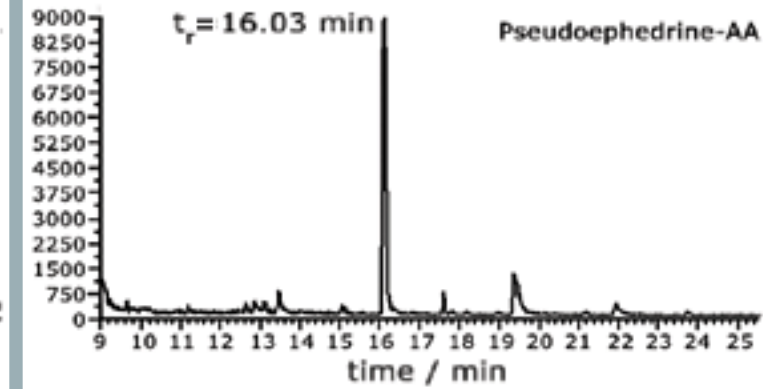
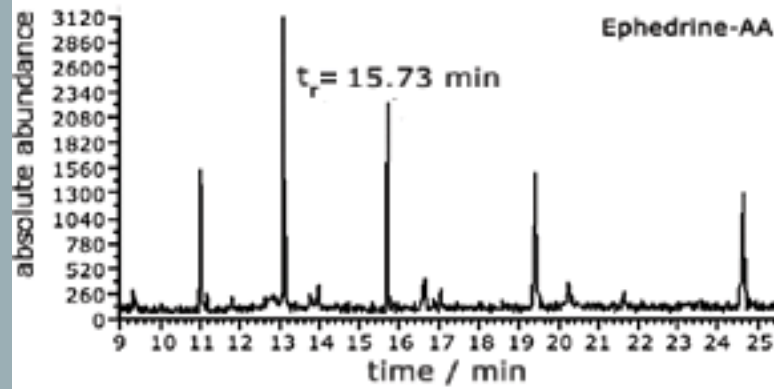
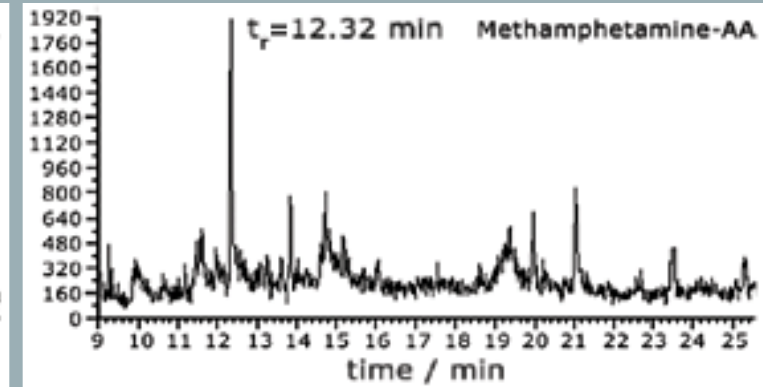
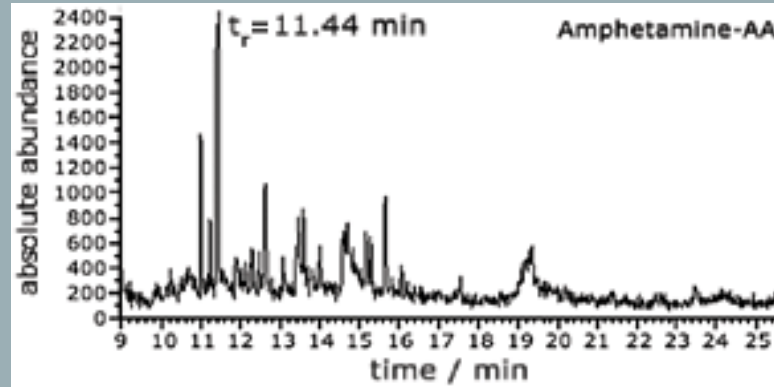


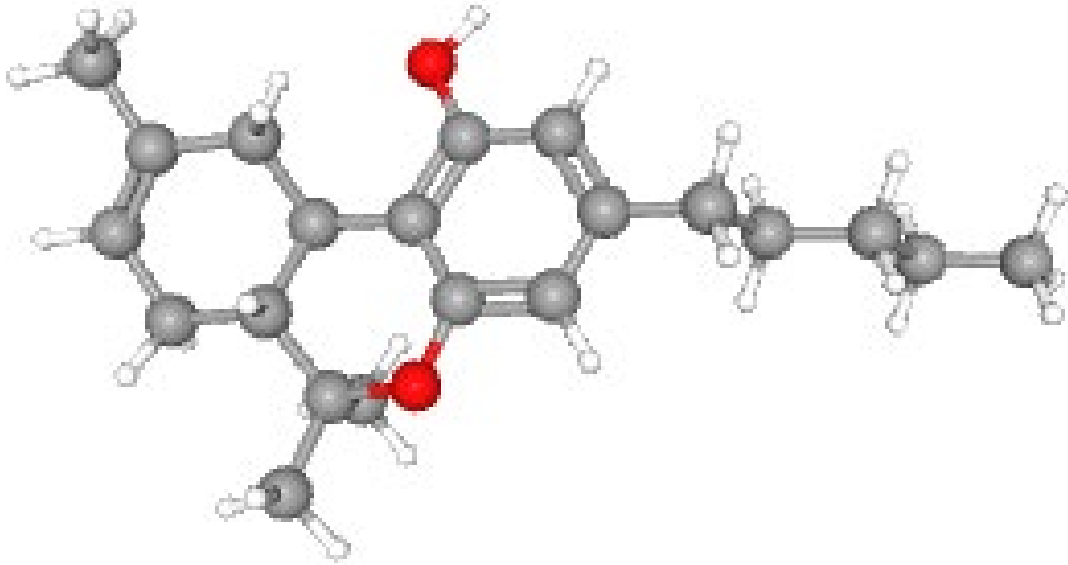
GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)
CAN DISTINGUISH BETWEEN SIMILAR COMPOUNDS



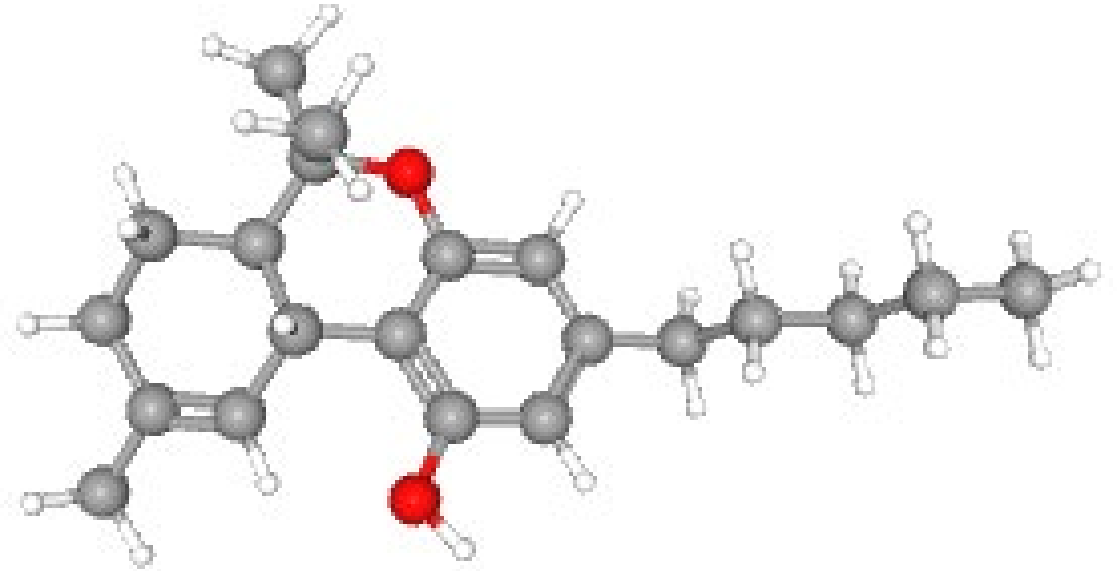
HOW GC/MS WORKS

GC/MS RESULTS





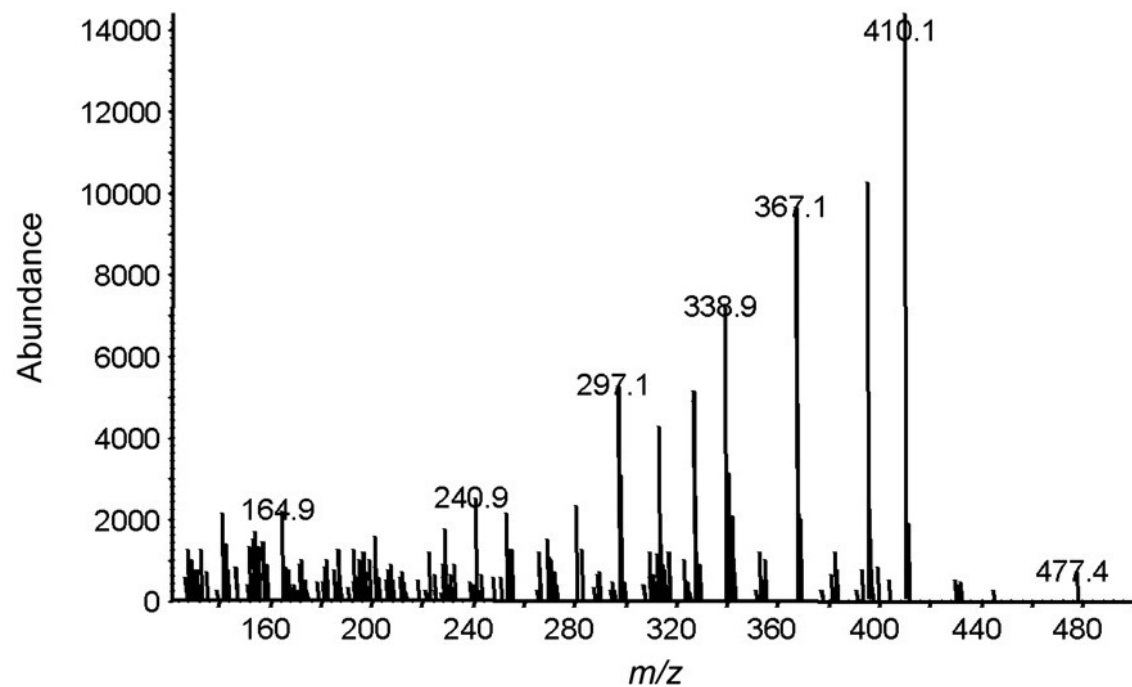
- Δ^9 -tetrahydrocannabinol carboxylic acid



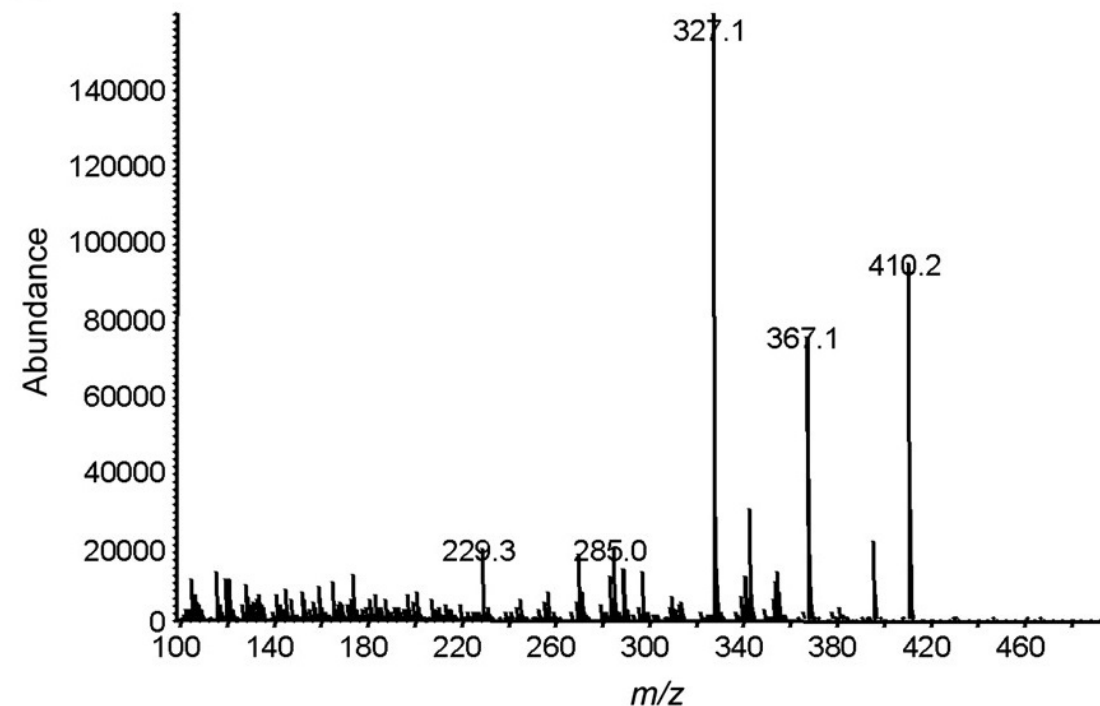
- Δ^8 -tetrahydrocannabinol carboxylic acid

VARIATIONS ON MARIJUANA

Δ^9 -tetrahydrocannabinol carboxylic acid



Δ^8 -tetrahydrocannabinol carboxylic acid



GC/MS RESULTS

CHEMISTRY LESSON 4

STOP LOOKING FOR THE LEVELS TO GO DOWN



WHAT DO THE NUMBERS ON THE LAB REPORT MEAN?

Forensic Fluids Laboratories
225 Parsons Street Kalamazoo, MI, 49007
(866)492-2517 ph (269)492-7704 fax

Report To: St. Joseph County DCS
300 N. Michigan Suite 230
South Bend, IN 46601

Report Date: 7/15/2014 08:31
Collector: [REDACTED]
Collected: 7/10/2014 00:00

Specimen ID: S0657855
Donor Name/ID: [REDACTED]
Lab ID: 765699
Received: 7/14/2014 08:25

Panels:	Result	Quantitation	Screen Cutoff	Confirm Cutoff
AMPHETAMINE	Negative		20 ng/mL	
METHAMPHETAMINE	Negative		20 ng/mL	
THC	POSITIVE		1 ng/mL	
delta-9 tetrahydrocannabinol	POSITIVE	44.9 ng/mL		0.5 ng/mL
COCAINE	Negative		5 ng/mL	
OPIATES	Negative		ng/mL	
BENZODIAZEPINES	Negative		10 ng/mL	
BARBITURATE	Negative		100 ng/mL	
METHADONE	Negative		5 ng/mL	
PCP	Negative		2 ng/mL	
OXYCODONE	Negative		50 ng/mL	
PROPOXYPHENE	Negative		100 ng/mL	

Approved By:

X Bridget Lorenz Lemberg Piyadareha Amarasinga, PhD Jessica Adamczyk Brian Higgins Donna Cox, PhD John Epstein, MD	Lab Director/Toxicologist Certifying Scientist, R&D Certifying Scientist Certifying Scientist Certifying Scientist MRO
---	---

CLIA # 23D1045429
Confirmed by LC/MS/MS.

Some [courts] interpret changes in quantitative levels of drug metabolites as evidence that new substance use has occurred... Unless a [court] has access to an expert trained in toxicology, pharmacology, or related discipline, such practices should be avoided. Quantitative metabolite levels can vary considerably based on a number of factors, including the total fluid content in urine or blood.

Cary, P. (2004). Urine drug concentrations: the scientific rationale for eliminating the use of drug test levels in drug court proceedings. *NDCI Drug Court Practitioner Fact Sheet*, (1).

CHEMISTRY LESSON 5

HAIR FOLLICLE TESTING IS NOT MAGIC



WARNING

Unfortunately, it has become clear that data in child protection cases involving hair analysis for markers of illicit drug and alcohol misuse, respectively, has either not always been presented in a way that enabled the Courts to give proper weight to the evidence, or has been erroneous, with incalculable consequences for the families involved.

Cuypers E, Flanagan RJ. The interpretation of hair analysis for drugs and drug metabolites. Clin Toxicol (Phila). 2018 Feb;56(2):90-100.

WHY TEST HAIR?

- Hair is composed mostly of protein
- Principle protein = keratin
- Drug metabolites in bloodstream are deposited into hair follicle
- Drug metabolites get trapped in keratin matrix of hair as it grows
- Drug metabolites can be reliably isolated from the most recent 3.75cm of growth

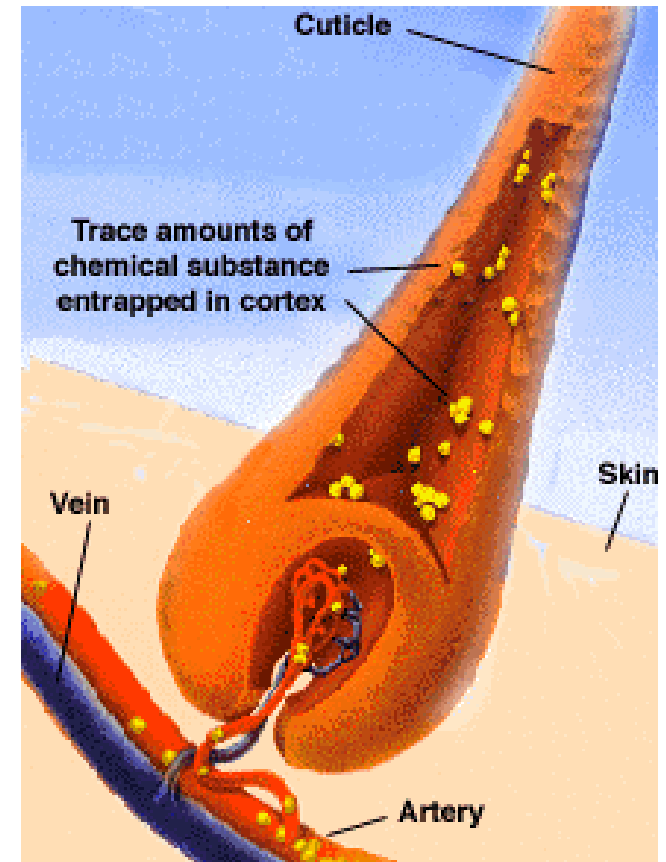
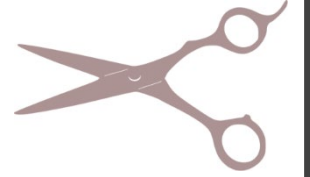


Illustration of Human Hair



HAIR FOLLICLE TESTING



ADVANTAGES

- Longer detection window (~90 days)
- Relatively non-invasive
- Difficult to adulterate
- Stable specimen

DISADVANTAGES

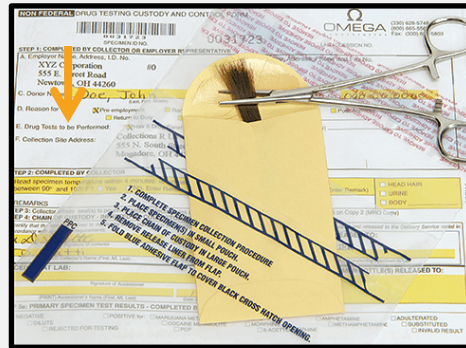
- Unable to detect recent use
- More expensive
- May not be available if subject is bald
- Risk of false positives from environmental exposure
- Requires laboratory analysis
- Hair color bias

HAIR TESTING PROCESS

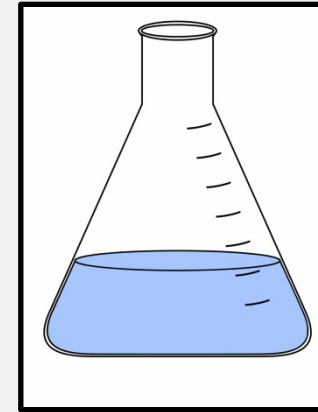
SAMPLE COLLECTION



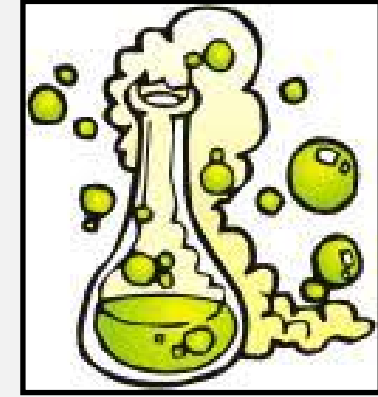
OFF TO THE LAB



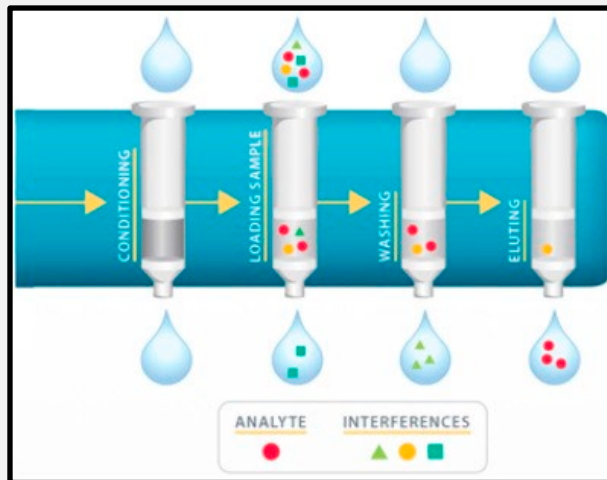
SOLVENT WASH



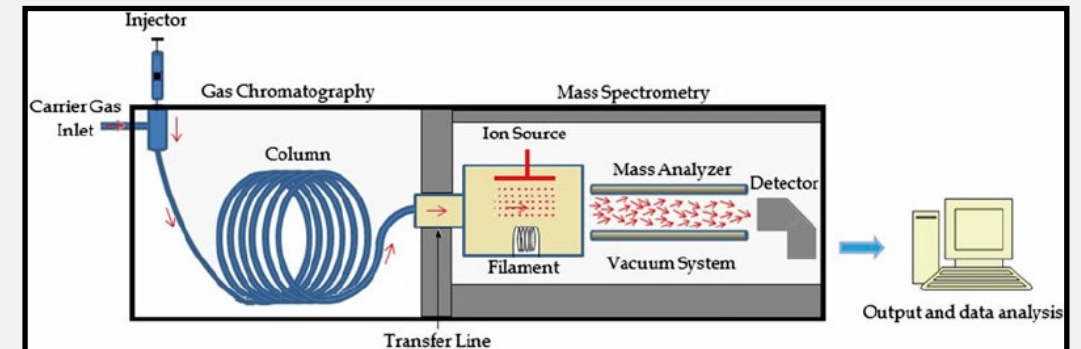
DIGESTION



EXTRACTION

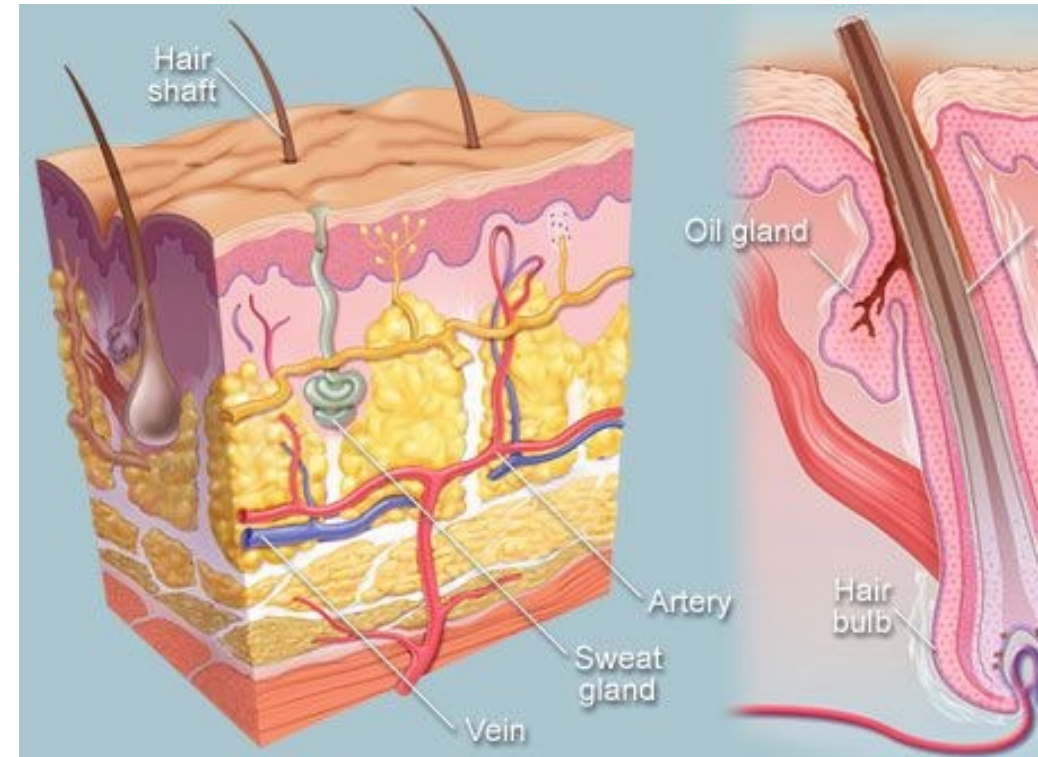


GC/MS ANALYSIS



OTHER WAYS DRUG
METABOLITES CAN
BE INCORPORATED
INTO HAIR

Sweat at sebum



Environmental exposure



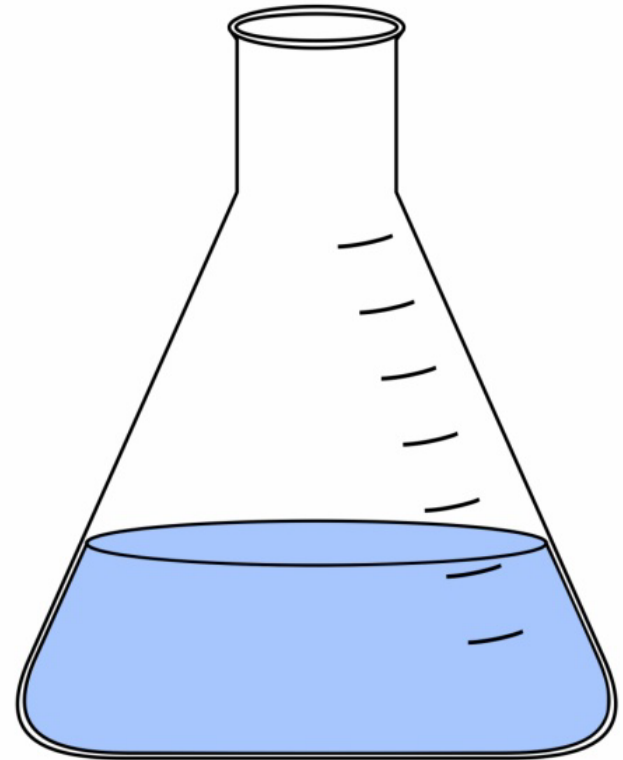


90-DAY WINDOW IS NOT EXACT

- Head hair grows at an average rate of 1cm per month
- 3cm sample represents roughly a 3-month period
- Variations in hair growth rate
- Variations in how close to the scalp the hair is cut

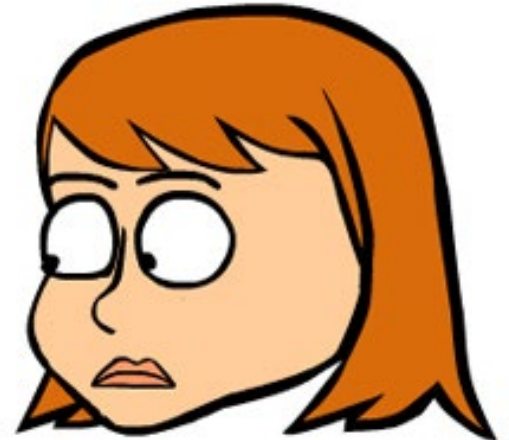
RISK OF SWEAT, SEBUM, OR ENVIRONMENTAL CONTAMINATION

- No set standard for decontamination across industry
- Washing procedures may move surface contaminants into the hair matrix
- No 100% reliable way to distinguish ingestion from environmental contamination



EFFECT OF HAIR COLOR

- Melanin is responsible for hair color
- Melanin is a polymer consisting of eumelanin (black/brown) and pheomelanin (red)
- Some drug metabolites bind more to eumelanin than pheomelanin



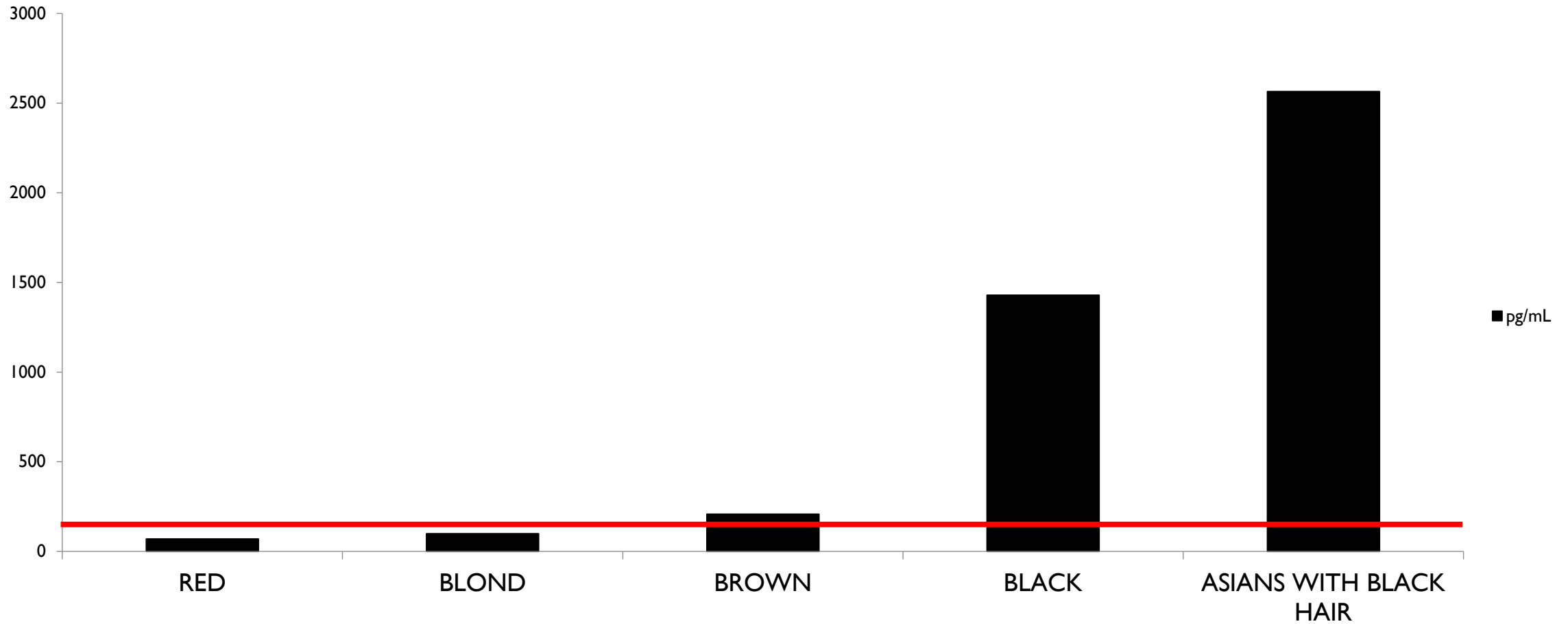
THE ROLLINS STUDY

Even among persons with the same hair color, there are racial differences in drug metabolite intake

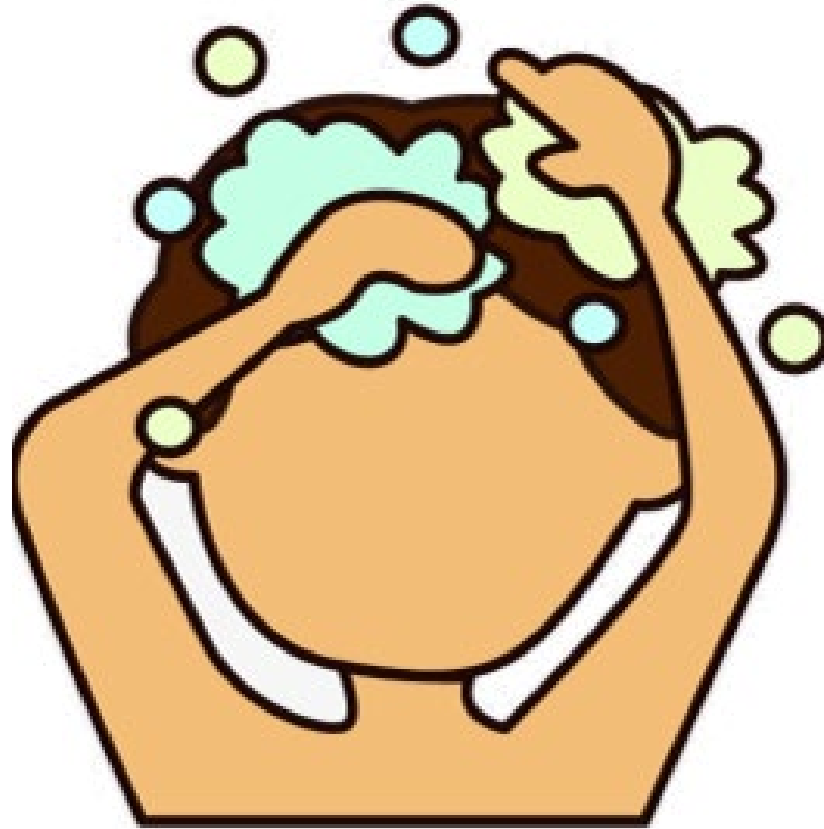
After the same dosage pattern of codeine, Asians with black hair tested 56% higher than Caucasians with black hair. Asians have a higher percentage of melanin in their hair.

Rollins DE, Wilkins DG, Krueger GG, et al. The effect of hair color on the incorporation of codeine into human hair. J Analytical Toxicol. 2003;27:545-551.





HAIR FOLLICLE TEST RESULTS AFTER
5 WEEKS OF CODEINE DOSING



CHEMICAL TREATMENTS AND SHAMPOOS

Slight decrease in metabolite concentrations for cocaine, monoacetylmorphine, and marijuana, but not enough to cause a positive hair specimen to test negative.

Rohrich J, Zorntlein S, Potsch L, Skopp G, Becker J. Effect of the shampoo Ultra Clean on drug concentrations in human hair. *Int J legal Med.* 2000;2:102-106.

Bleaching can affect the stability to benzodiazapines in hair and result in decreased drug concentrations on testing, but not to the extent that regular benzodiazepine use would not be detected.

Yegles M, Marson Y, Wennig R, Influence of bleaching on stability of benzodiazapines in hair. *Forensic Sci Int.* 2000;1-7:87-92.



Bleaching and chemical treatment also make hair more susceptible to drug uptake from environmental exposure.

Skopp G, Potsch L, Moeller M. On cosmetically treated hair: aspects and pitfalls of interpretation. *Forensic Sci Int.* 1997;84:43-52.

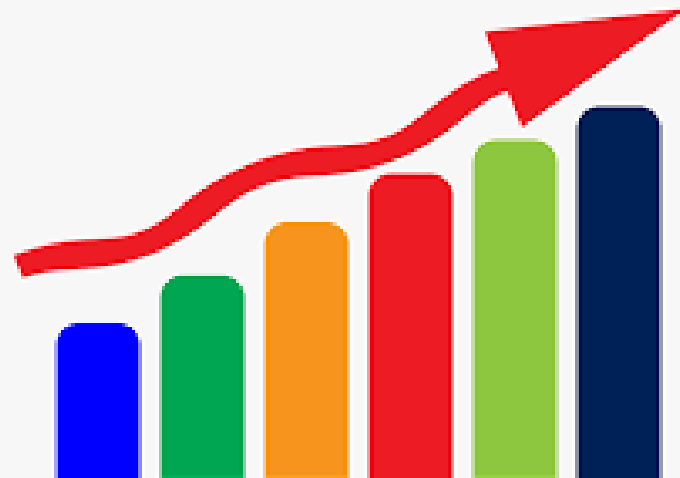
In all cases studied, the drug content in hair that had undergone treatment decreased in comparison with untreated hair with mean differences of between approximately 40%–60% depending on the substance, type of treatment, and the extent of hair damage.

Jurado, C., Kintz, P., Menéndez, M., & Repetto, M. (1997). 'Influence of the cosmetic treatment of hair on drug testing' in <http://www.ncbi.nlm.nih.gov/pubmed/9228567>; 110(3):159–63. PMID: 9228567.

CAN WE COMPARE LEVELS FROM TEST TO TEST?

Incorporation of drugs into the hair is not consistent from person to person or even across multiple ingestions by a single person.

Kitnz P, Bundeli P, Brenneisen R, Ludes B. Dose-concentration relationship in hair from subjects in a controlled heroin-maintenance program. *J Analytical Toxicol.* 1998;22:231-236.



CHAIN OF CUSTODY

- Collection
- Sample
- Sample Sent to Lab
- Received by Lab
- Lab Process
- Results




EXAMINATION OF DRUG COLLECTOR/TESTER

- Training
- Home, Office, Lab, Etc.
- Type of Test
- Collection
- From Where?
- Sample Packaging
- Sample Sent to Lab
- Receipt of Sample
- Testing



ADMISSION OF DRUG TEST

Foundation
Mark
Show
Approach
Identify

CERTIFICATE OF ANALYSIS  **AlphaBiolabs**
More Care . More Convenience . More Value

Instructing Agency: [REDACTED]	Case Ref. No: TL06126	Sample Details
	Sample Donor Details	Sample Type: Chest Hair
	Forename: [REDACTED]	Date Collected: 11-Apr-17
	Surname: [REDACTED]	Date Received: 11-Apr-17
	Date of Birth: [REDACTED]	Date Reported: 18-Apr-17
	Sex: [REDACTED]	Hair Length: N/A
		Hair Segment: N/A
		Start of Time Period: end of Mar 2016
		End of Time Period: end of Mar 2017

LC-MS/MS TEST RESULTS

Drug Group	Compound	Cut-Off (ng/mg)	Concentration (ng/mg)
Opiates	Morphine	0.2*	Negative
	Dihydrocodeine	0.2*	Negative
	Codeine	0.2*	Negative
	6-Monoacetylmorphine (6-MAM)	0.2*	Negative

* Society of Hair Testing (SoHT) recommended cut-off guideline values.

Questions?

Darice M. Good, J.D., CWLS

darice@goodlegalfirm.com

www.goodlegalfirm.com

404.234.5475

Diana Rugh Johnson, JD, CWLS

diana.johnson@georgiacourts.gov

404.276.0045