

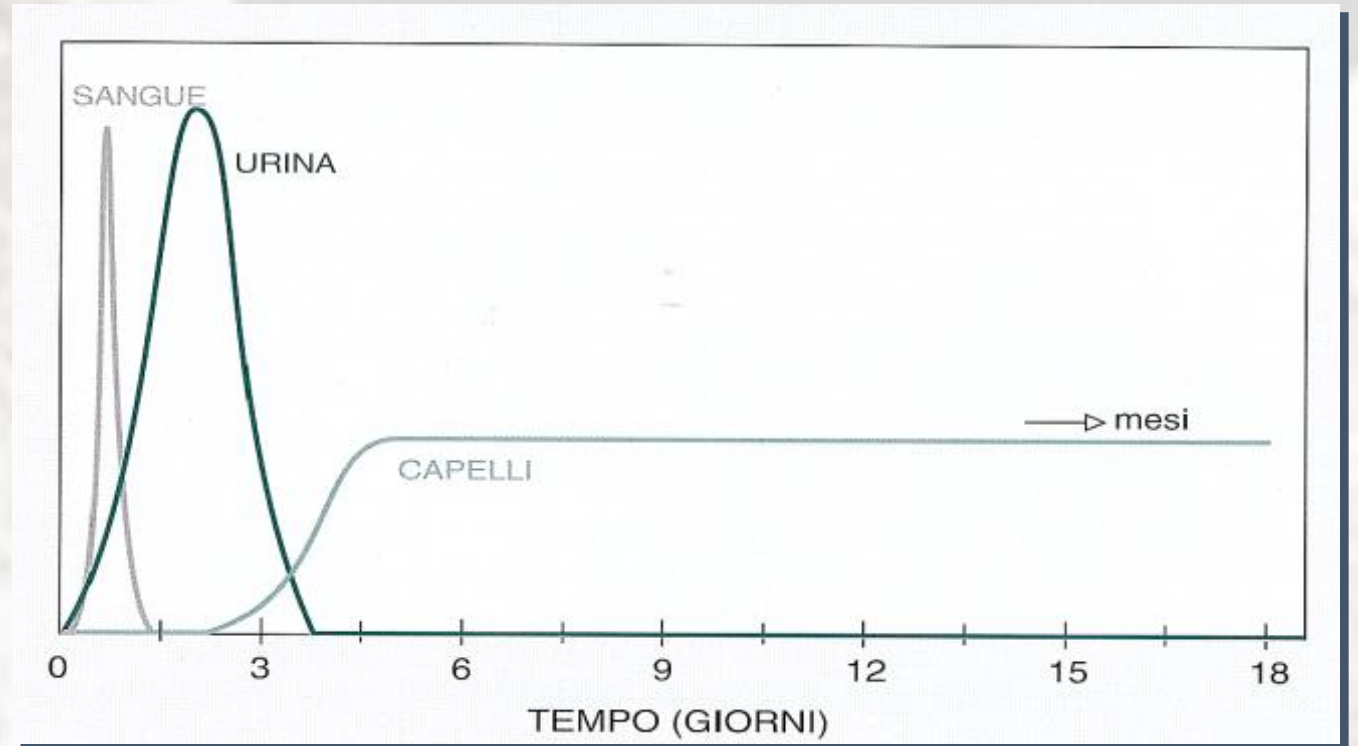
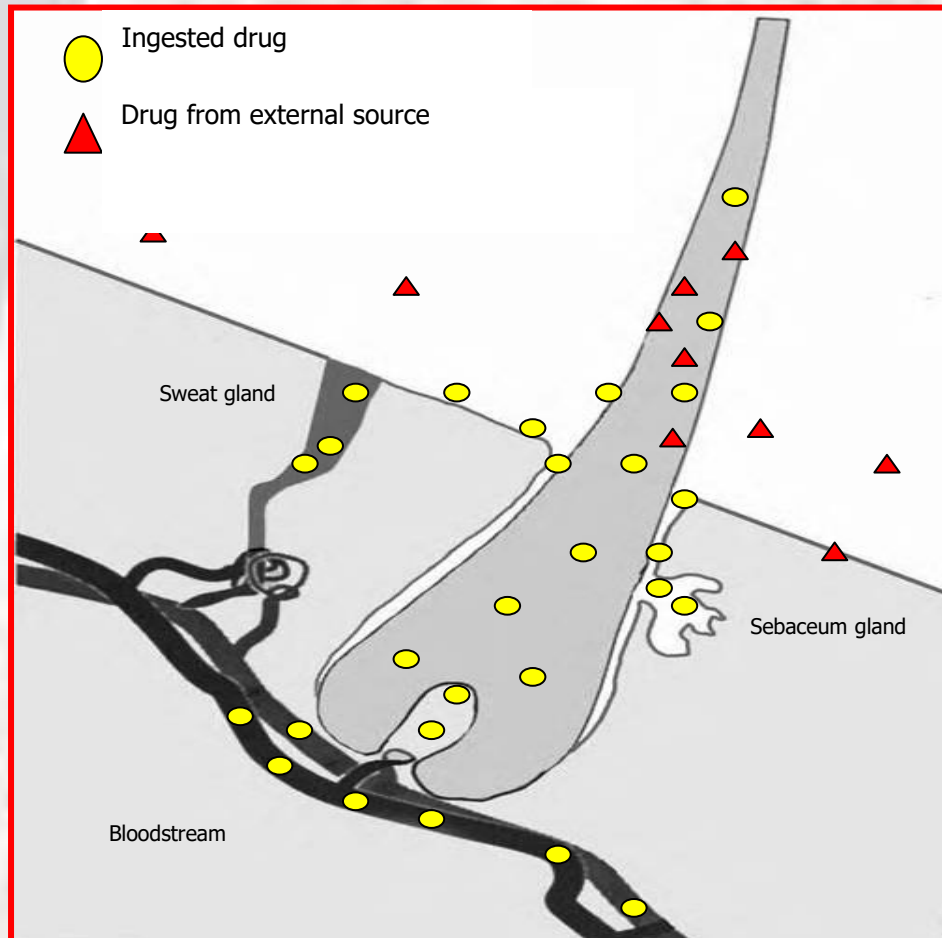
COME E QUANDO USARE LA MATRICE CHERATINICA?

Alberto SALOMONE

SUMMARY

- Framing hair analysis
- Acute intoxication/chronic exposure from DOA
- Acute intoxication/chronic exposure from NPS
- Acute intoxication/chronic exposure from pharmaceutical drugs
- Doping cases
- Drug Facilitated Sexual Assault (DFSA)
- Children

MAIN FEATURES



**METABOLITES TO SUSTAIN
ACTIVE USE**

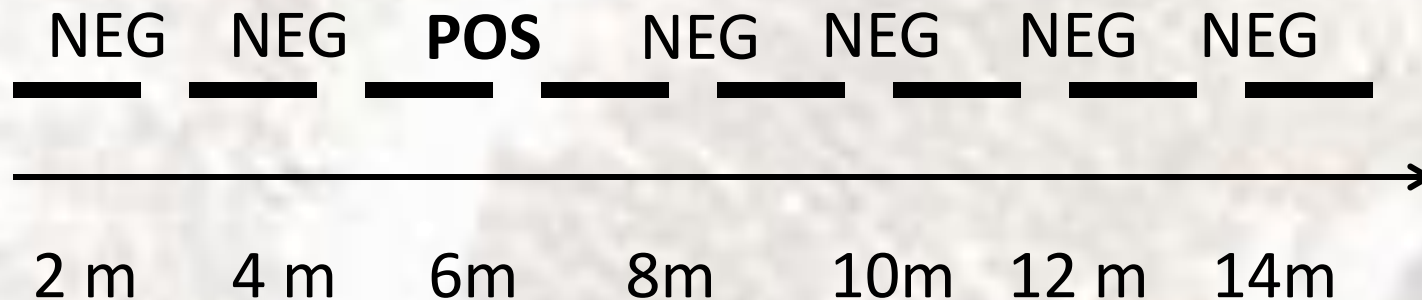
HAIR ANALYSIS

HAIR GROWTH

- Anagen phase: 85% of the hairs
- Catagen phase: <1%
- Telogen phase: 15%

Hair Type	Mean cm/month (Range)
Head	1.05 (0.6 – 1.5)
Pubic	0.75 (0.60 – 0.90)
Chest	0.98 (0.81 – 1.5)

SEGMENTAL ANALYSIS







The role of variations in growth rate and sample collection on interpreting results of segmental analyses of hair[☆]

Marc A. LeBeau^{*}, Madeline A. Montgomery, Jason D. Brewer

U.S. Federal Bureau of Investigation, Laboratory Division, 2501 Investigation Pkwy, Quantico, VA 22135, USA

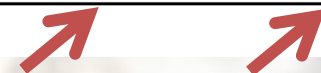


14 collectors (5 experienced, 9 not trained)

Table 3

Average lengths of hair remaining at sampling areas after collection by novice and expert evidence collection volunteers.

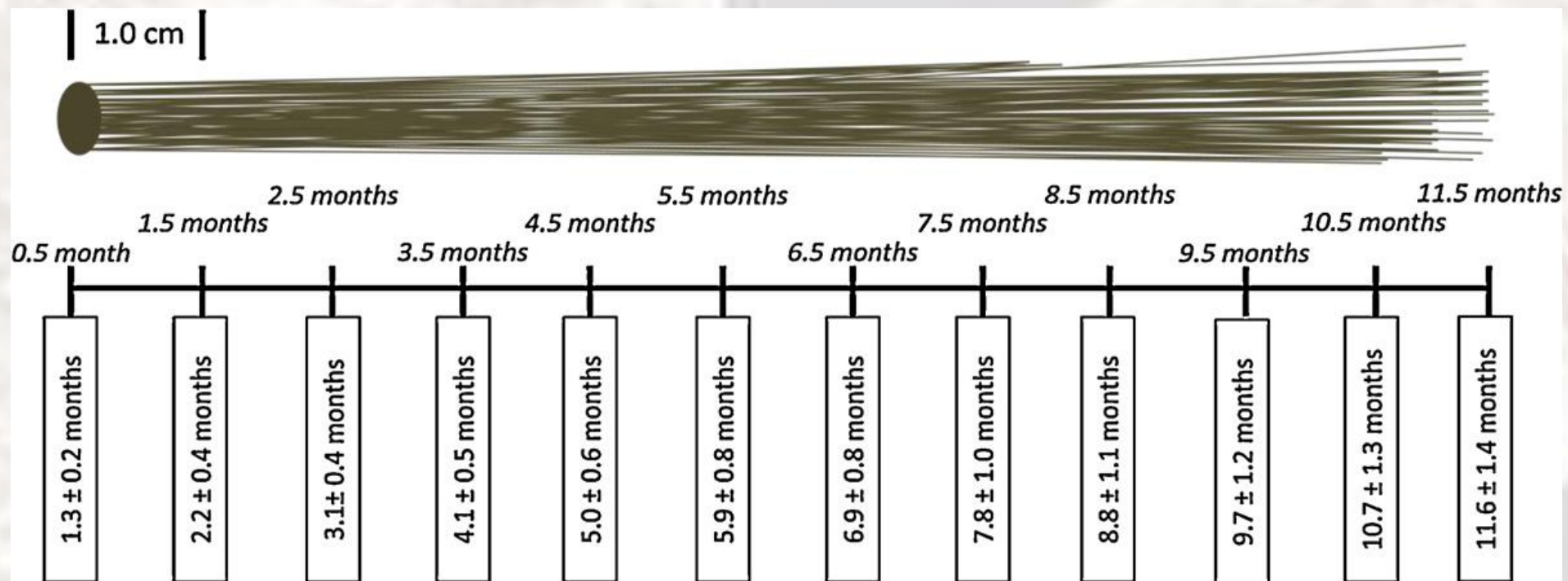
	Novice (<i>n</i> = 18)	Expert (<i>n</i> = 10)
Avg. shortest length of remaining hair (cm):	0.4 ± 0.1	0.4 ± 0.0
Avg. longest length of remaining hair (cm):	1.4 ± 0.2	1.0 ± 0.1
Avg. length of remaining hair (cm):	0.9 ± 0.1	0.7 ± 0.1



The role of variations in growth rate and sample collection on interpreting results of segmental analyses of hair[☆]

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REAL CASE – DOA/NPS

- 30-year-old male, severe state of hallucination and agitation, tachycardia (160 bpm), external body temperature 38.0°C
- Laboratory: metabolic acidosis (pH 7.17), lactate concentration 13 mEq/L
- Sedated with midazolam, diazepam, chlorphenamine maleate, haloperidol
- After 12 hrs: CK: 87923 U/L; ALT: 77 U/L; AST: 500 U/L; LDH: 4908 U/L

REAL CASE - DOA/NPS

- Urine screening: AMP, THC, BZO
- Blood confirmation GC-MS and LC-MS: midazolam, diazepam, haloperidol, THC, lormetazepam, diphenidine
- Hair sample: α -PVP, MDPV, MXE, 4-FA, METHYLONE and DIPHENIDINE

REAL CASE – Pharmaceuticals

- A 49 year-old female nurse started feeling various symptoms including muscular rigidity, drowsiness and buccal dyskinesia (three different occasions)
- No blood or urine available
- Hair sample is collected

REAL CASE – Pharmaceuticals

SEGMENT	LENGTH (cm)	RESULTS
Segment A	0-1	Haloperidol: 1.4 ng/mg
Segment B	1-6	Haloperidol: 0.5 ng/mg
Segment C	6-9	Haloperidol: 1.9 ng/mg
Segment D	9-14	Negative (< 1 pg/mg)

Conclusions: the victim was continuously administered haloperidol

REAL CASE – Poisons

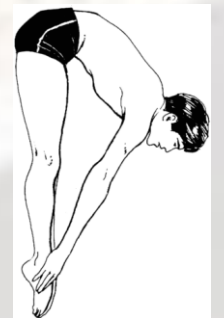
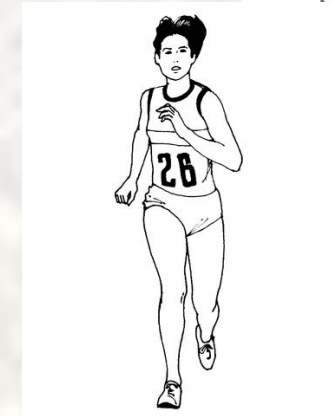
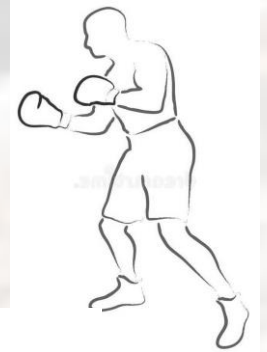
- A 97-years old woman was hospitalized because of severe symptoms, including drowsiness, convulsions, pallor and hematoma
- Abnormal values for coagulation parameters (PT-INR = 12.46; aPTT = 60 s; aPTT ratio = 1.82).
- Dismissed after IV administration of 10 mg vitamin K
- After 1 week, the woman is taken again to the ED because of the same symptoms

REAL CASE – Poisons

- Blood sample: positive to difenacoum
- Hair sample: 9 cm
- Segment A (0-3 cm): difenacoum 2.9 pg/mg, α -Chloralose 85 pg/mg
- Conclusions: the victim was administered difenacoum in few isolated occurrences, and was repeatedly exposed to α -chloralose

REAL CASE – Doping agents

- A professional boxer, male, 33 years old, was found positive in urine after an *in-competition* control (Clostebol metabolite: 1 ng/mL)
- A 45-years-old long-distance runner, female, was found positive in urine after an *in-competition* control (Clostebol metabolite 15 ng/mL)
- A young male diver, 18 years old, was found positive in urine after an *in-competition* control (Clostebol metabolite 1 ng/mL).



Results

Case	Specimen	Total Length (cm)	Analyzed Length (cm)	Clostebol	Clostebol acetate
#1 boxer	Arm hair	3	Full length	neg	3 pg/mg
#1 boxer	Leg hair	3	Full length	neg	5 pg/mg
#1 boxer's wife	Head hair	12	Segment 0-2	neg	neg
			Segment 2-5	neg	13 pg/mg
			Segment 5-12	neg	neg
#2 runner	Head hair	10	Segment 0-2	neg	21 pg/mg
			Segment 2-10	neg	neg
#3 diver	Head hair	2	Segment 0-1	neg	neg
			Segment 1-2	neg	neg
#3 diver	Pubic hair	3	Full length	neg	neg

REAL CASE – DFSA

REPORT #1



- 26 year-old Caucasian woman
- drinks a coffee offered by her employer
- loss of consciousness and memory for several hours
- recalls palpations made by her employer



not known

REPORT #2

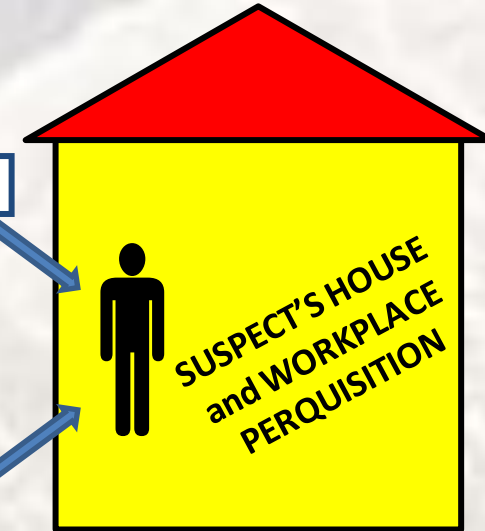


- 41 year-old African woman
- drinks a juice offered by her acquaintance
- loss of consciousness and memory for several hours
- reports vaginal bleeding
- reports the case to the police 16 months later



employment

friendship



REAL CASE – DFSA



Blood
 Δ^9 -THC-COOH
7.4 ng/mL

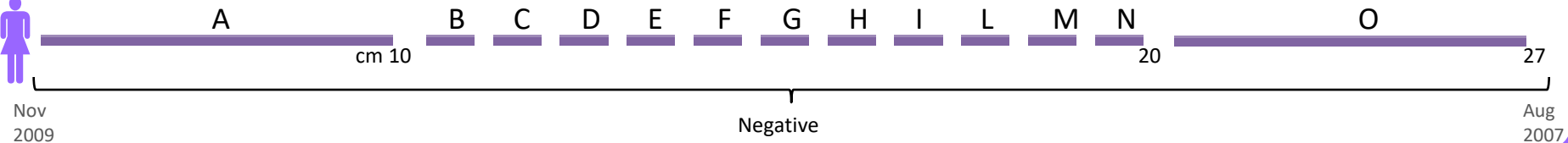
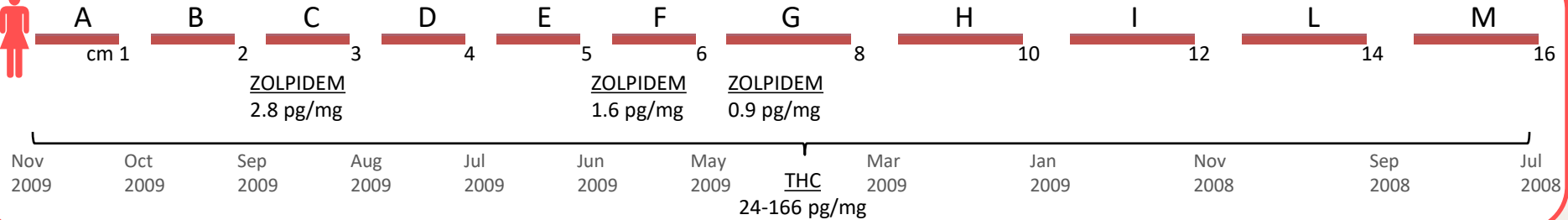


Urine
 Δ^9 -THC-COOH
108 ng/mL

✓ No traces of rape drugs



Frequent use of cannabis
Exposure to Zolpidem in the periods Mar-Jun 2009 and Aug-Sep 2009. No regular consumers of Zolpidem



HAIR ANALYSIS

CHILDREN

1. Prenatal exposure
 2. Sedate to keep them quiet
 3. Sedate for sexual assault
 4. Accidental ingestion
 5. Passive contamination
- Analysis: no difference (lower amount of sample)
 - Pharmacology: DIFFERENT
 - Hair analysis: DIFFERENT

REAL CASE #1

- Episode: 07.12.2018
- Taken from school, dizzy and disoriented, ER
- Blood: traces of lormetazepam
- Hair collected on 21.12.2018

REAL CASE #1

- Length: 4.5 cm (4.5-5.0 months)

SEGMENT	LENGTH (cm)	Diagnostic window	RESULTS
Segment A	0-1	November – December 2018	Lormetazepam: 8 pg/mg Lorazepam: 3 pg/mg
Segment B	1-2	October – November 2018	Lormetazepam: 9 pg/mg Lorazepam: Negative (< 1 pg/mg)
Segment C	2-3	September – October 2018	Lormetazepam: 17 pg/mg Lorazepam: Negative (< 1 pg/mg)
Segment D	3-4.5	August - September 2018	Lormetazepam: 35 pg/mg Lorazepam: Negative (< 1 pg/mg)

REAL CASE #2

- ER: on 16.10.2018, E.L. (2.5 years, 11.5 kg) overdose methadone, GCS 5
- ICU: Unconscious, administered naloxone and oxygen therapy, GCS 13
- Blood methadone: 520 ng/ml
- Mother is under therapy with methadone
- Used heroin since the 8th month of pregnancy
- Breast feeding until 9th month
- Both parents admit use of heroin (smoked)

REAL CASE #2

- «Durante il primo periodo di allattamento non ho fatto uso di eroina; successivamente il medico mi ha detto che se avessi fatto un moderato uso di eroina non avrei rischiato contaminazione nel caso di allattamento nelle 24 ore successive e, così ho fatto»
- Accidental ingestion of methadone of chronic exposure/administration?
- Tolerance?

- Length: 25 cm (2-2.5 years)

SEGMENT	LENGTH (cm)	Diagnostic window	Methadone	EDDP	Morph	6-MAM
Segment A	0-1	November – December 2018	0.25 ng/mg	<cut-off	0.06 ng/mg	0.07 ng/mg
Segment B	1-2	October – November 2018	2.40 ng/mg	<cut-off	0.36 ng/mg	1.53 ng/mg
Segment C	2-3	September – October 2018	0.46 ng/mg	<cut-off	0.10 ng/mg	0.34 ng/mg
Segment D	3-5	July - September 2018	1.68 ng/mg	<cut-off	0.35 ng/mg	2.84 ng/mg
Segment E	5-7	May - July 2018	2.14 ng/mg	<cut-off	1.01 ng/mg	6.67 ng/mg
Segment F	7-9	March - May 2018	2.00 ng/mg	<cut-off	1.07 ng/mg	6.04 ng/mg
Segment G	9-11	January - March 2018	1.94 ng/mg	<cut-off	1.48 ng/mg	7.33 ng/mg
Segment H	11-18	June 2017 - January 2018	1.44 ng/mg	<cut-off	1.12 ng/mg	6.86 ng/mg
Segment I	18-25	December 2016 - June 2017	2.22 ng/mg	<cut-off	1.10 ng/mg	7.47 ng/mg

REAL CASE #2

- In utero exposure: unlikely
- Breast feeding: unlikely (for the more recent segments)
- External contamination: likely
- Passive exposure or intake of heroin?



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Communication

Pediatric Exposure to Drugs of Abuse by Hair Testing: Monitoring 15 Years of Evolution in Spain

Simona Pichini ^{1,*}, Oscar García-Algar ^{2,3}, Airam-Tenosor Alvarez ², Maria Mercadal ²,
Claudia Mortali ¹, Massimo Gottardi ⁴, Fiorenza Svaizer ⁴ and Roberta Pacifici ¹

Hair analysis of more than 140 families with drug consuming parents. Comparison between hair results from adults and their children

Fritz Pragst  , Franziska Krumbiegel , Denise Thurmann , Lena Westendorf , Maximilian Methling , André
Niebel , Sven Hartwig 



Public Health **2014**, *11*, 2288-2298; doi:10.3390/ijerph110202288

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Article

Assessment of Unsuspected Exposure to Drugs of Abuse in Children from a Mediterranean City by Hair Testing

Simona Pichini ^{1,*}, Oscar Garcia-Algar ², Airam Alvarez ², Massimo Gottardi ³, Emilia Marchei ¹,
Fiorenza Svaizer ³, Manuela Pellegrini ¹, Maria Concetta Rotolo ¹ and Roberta Pacifici ¹

CONCLUSIONS

- Hair sampling is highly recommended in all (unconventional) cases
- Hair must be collected by trained personnel
- Hair analysis can shed light on complex cases
- Cooperation between clinical and forensic toxicologist is essential for a correct interpretation