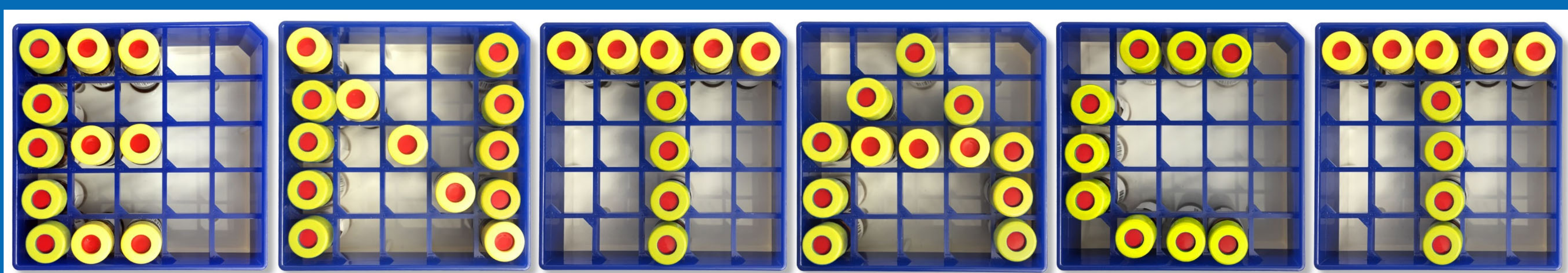
EPA United States Environmental Protection Agency

Non-Targeted Analysis at the U.S. Environmental Protection Agency

Elin M. Ulrich

U.S. Environmental Protection Agency
Center for Computational Toxicology and Exposure
Research Triangle Park, NC USA



Dust samples were determined to be environmental in nature and not human subjects research.

EPA NTA Research Contributors

- **ORD:** Angela Batt, Scott Clifton, Kathy Coutros, **Chris Grulke**, Chris Fuller, Kristin Isaacs, Hannah Liberatore, Charles Lowe, James McCord, Kelsey Miller, Jeff Minucci, **Seth Newton**, Katherine Phillips, Tom Purucker, Ann Richard, Charlita Rosal, **Jon Sobus**, Mark Strynar, Adam Swank, Elin Ulrich, Ariel Wallace, John Wambaugh, John Washington, **Antony Williams**

- **ORAU/ORISE/ASPPH**: Hussein Al-Ghoul, **Alex Chao**, Andrew Eicher, Jarod Grossman, Johnsie Lang, Sarah Laughlin-Toth, Jeremy Leonard, Kamel Mansouri, Aurelie Marcotte, Andrew McEachran, **Dawn Mills**, Marie Russell, **Randolph Singh**, Nelson Yeung

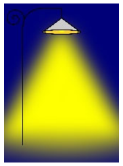
- **Contracts:** EvoTec, General Dynamics Information Technology

ENTACT was supported by EPA Stage 1-3 Pathfinder Innovation Project "Building a Network to Measure the Totality of Chemical Exposures."

Outline

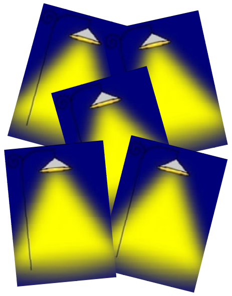
- **EPA's Non-Targeted Analysis Collaborative Trial (ENTACT)**
  - About NTA and ENTACT
  - Initial results
  - APCI vs ESI
  - Predicted mass spectra
- **Applications of NTA to house dust**
- **Existing tools and future plans for UVCBs**
- **Benchmarks and Publications for Non-Targeted Analysis**

What is Non-Targeted Analysis?



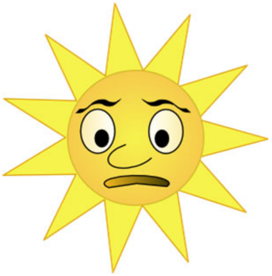
✧ **Targeted Analysis**

Standards, calibration curves



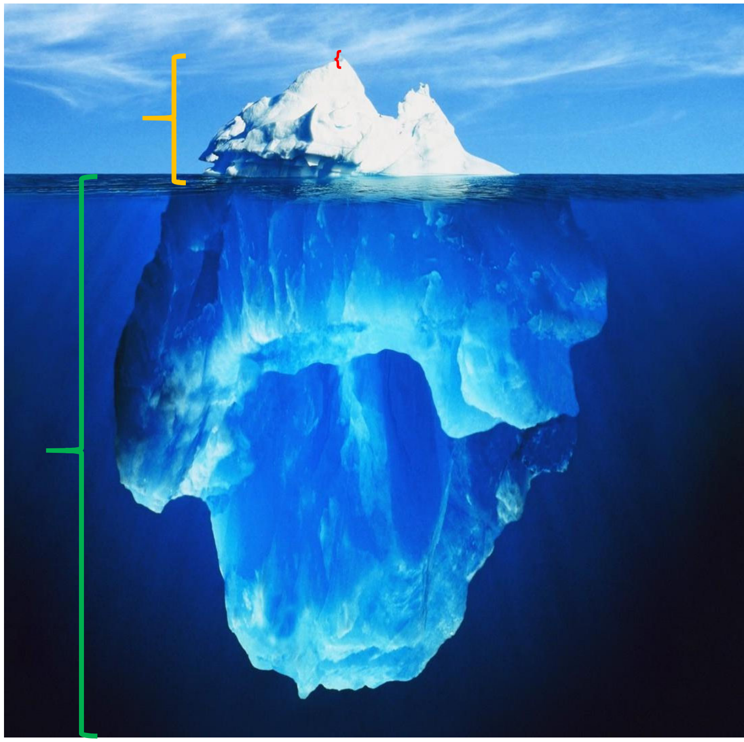
✧ **Suspect Screening Analysis (SSA)**

Lists of compounds



✧ **Non-Targeted Analysis (NTA)**

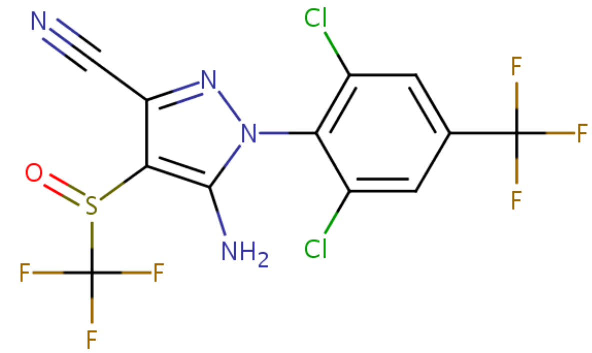
MS first principles



How does High Resolution MS work?

Atom	Natural Abundance	Exact Mass
^{1}H	99.9885%	1.007825
^{2}H	0.0115%	2.014102
^{12}C	98.93%	12.000000
^{13}C	1.07%	13.003355
^{14}N	99.632%	14.003074
^{15}N	0.368%	15.000109
^{16}O	99.757%	15.994915
^{17}O	0.038%	16.999131
^{18}O	0.205%	17.999159
^{19}F	100%	18.998403
^{32}S	94.93%	31.972072
^{33}S	0.76%	32.971459
^{34}S	4.29%	33.967868
^{36}S	0.02%	35.967079
^{35}Cl	75.78%	34.968853
^{37}Cl	24.22%	36.965903

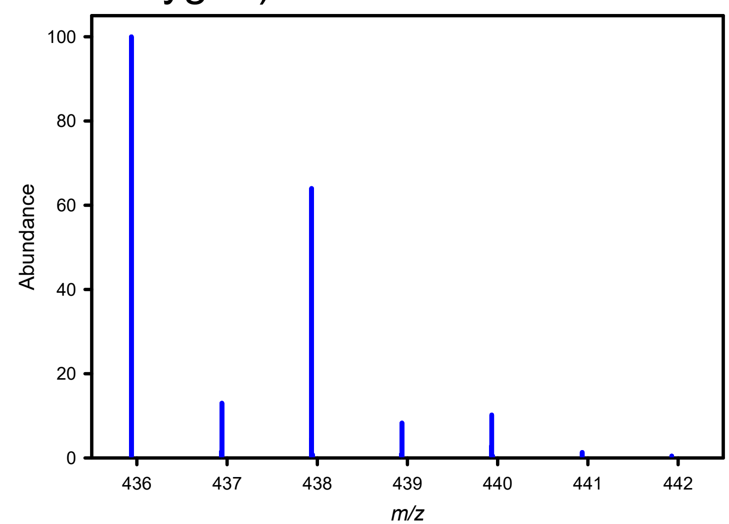
Example: Fipronil



Molecular Formula: $C_{12}H_4Cl_2F_6N_4OS$

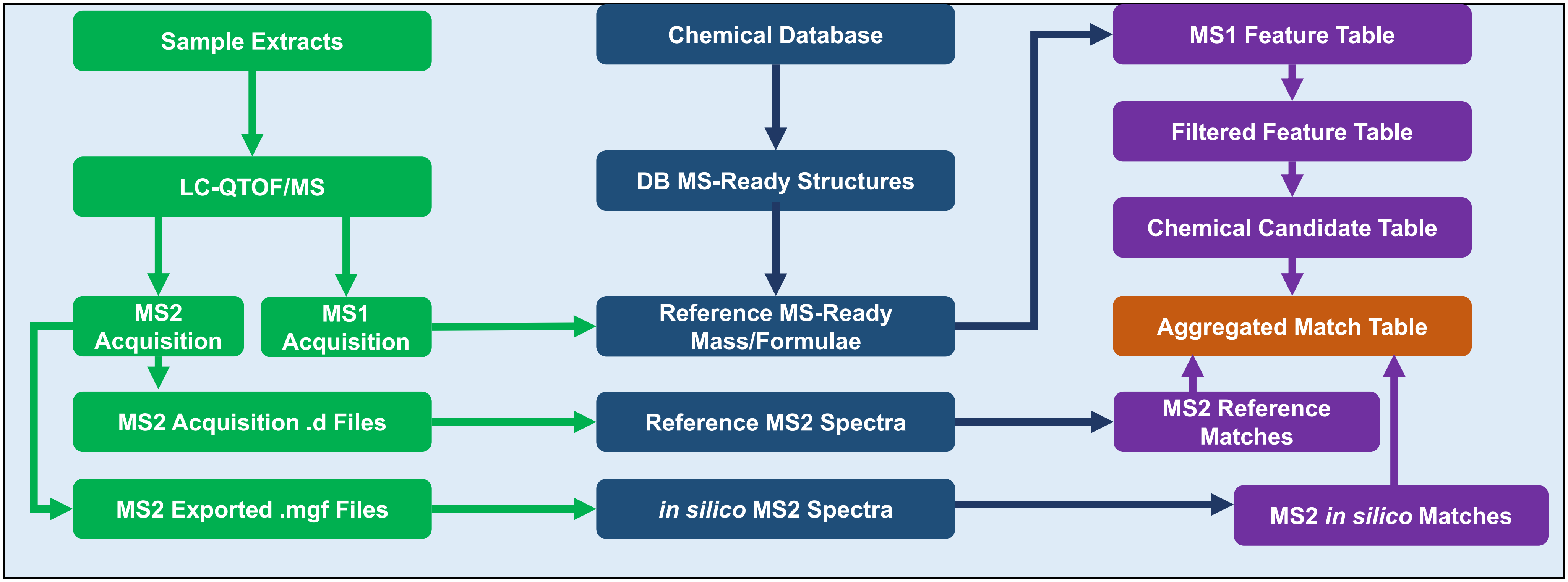
Monoisotopic Mass: 435.938706

= (12.0000*12 Carbon) + (1.007825*4 Hydrogen) + (34.968853*2 Chlorine) + (18.998403*6 Fluorine) + (14.003074*4 Nitrogen) + (15.994915*1 Oxygen) + (31.972072*1 Sulfur)



Non-Targeted Analysis Workflow

Experimental Acquisition | Database & Library Matching | Data Analysis & Computational Tools



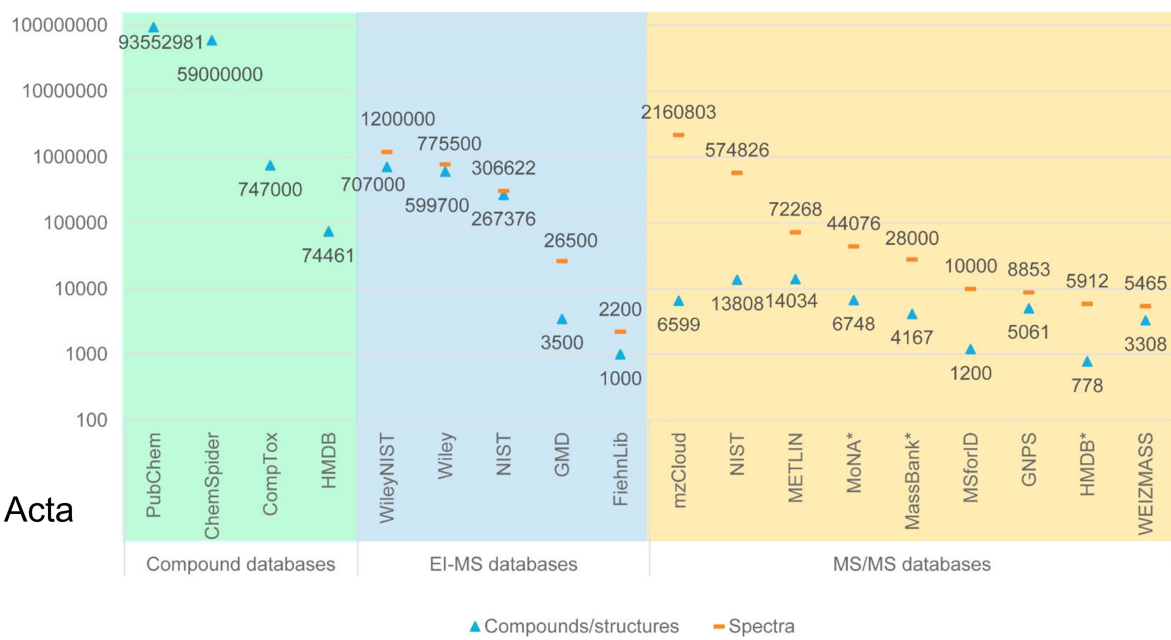
Analytical Instruments High resolution accurate mass, mass spectrometry (QToF, Orbitrap)

Chemical Databases CompTox Chemicals Dashboard, MassBank, PubChem

Computational Tools CPDat, media and retention time prediction, MetFrag, R/Python tools

EPA's Non-Targeted Analysis Collaborative Trial

- Characterize current method performance characteristics (e.g., % true/false positives)
- Establish performance benchmarks and benchmark methods for SSA and NTA
- Develop reporting standards for studies using SSA and NTA methods
- Increase compounds/spectra available in reference libraries (in-house and publicly available)
- And so much more…

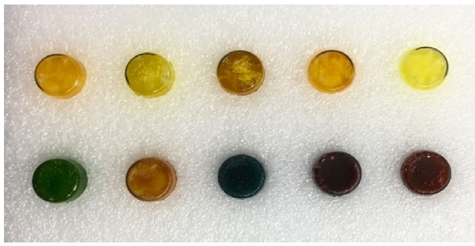


Peisl BYL, Schymanski EL, Wilmes P (2018) Anal. Chim. Acta 1037:13-27. https://doi.org/10.1016/j.aca.2017.12.034

ENTACT Sample Overview

Part 1. Ten ToxCast mixtures

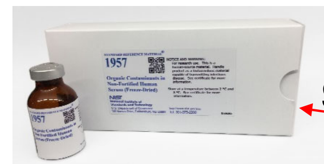
95, 185 or 365 substances/mixture



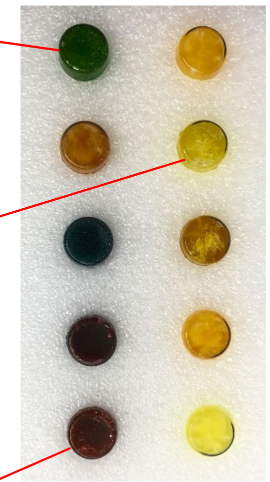
Part 2. Three standard exposure relevant extracts

Unaltered

Fortified



95



NIST SRM 1957-
Organic Contaminants in Non-fortified Human Serum

185

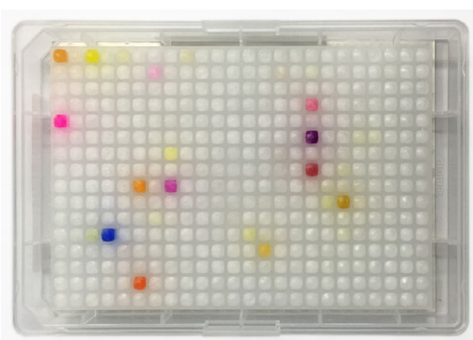
Oregon State University-
Outdoor air exposed silicone wrist-bands

365

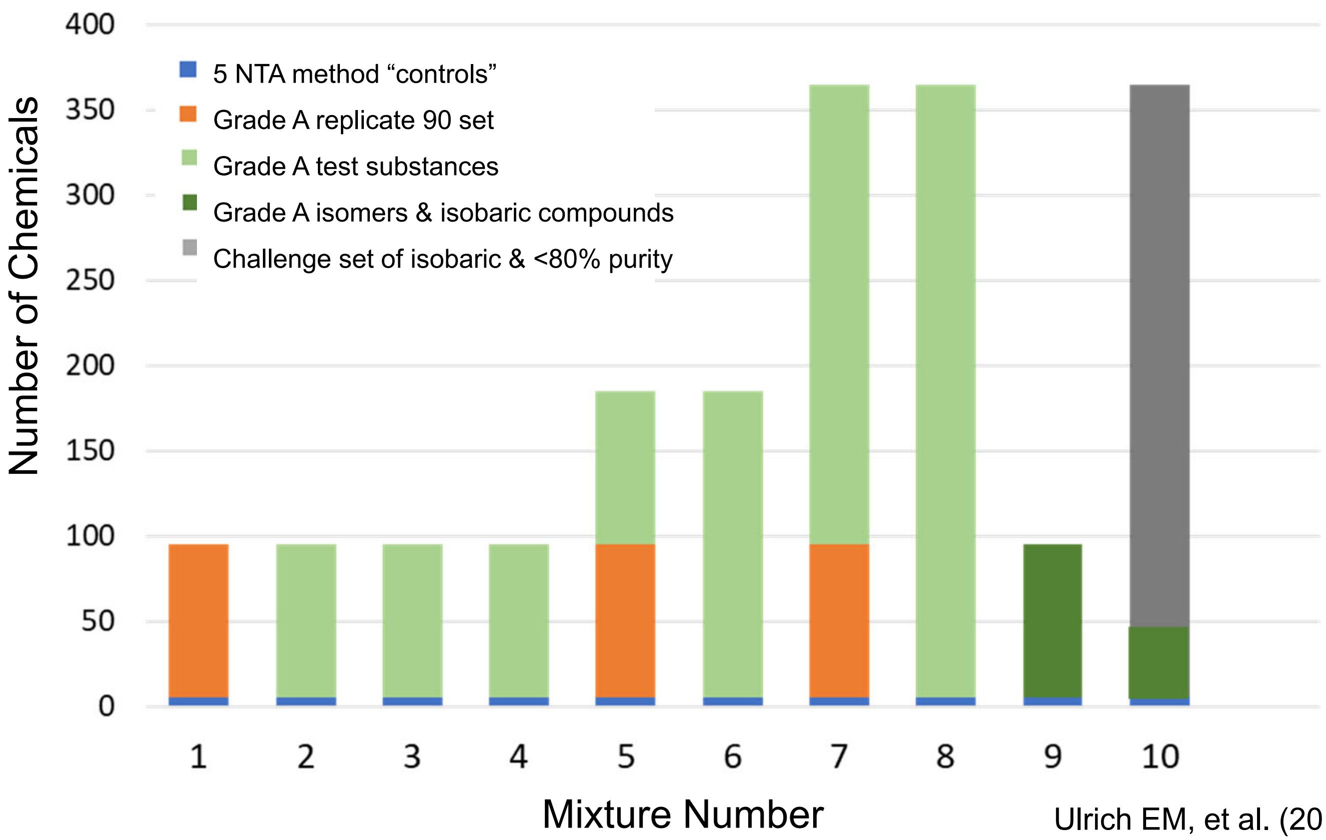
NIST SRM 2585-
Organic Contaminants in House Dust

Part 3. Individual ToxCast standards

1,269 ENTACT; 4,685 ToxCast all



ENTACT Mixtures- Brainchild of C. Grulke



<u>10 Prepared Mixtures</u>:

1,939 total spiked substances

1,269 unique substances:

1 → spiked 11 times

4 → spiked 10 times

57 → spiked 4 times

33 → spiked 3 times

388 → spiked 2 times

786 → spiked 1 time

Ulrich EM, et al. (2019) *ABC* 411:853-866. doi:10.1007/s00216-018-1435-6

Exposure Sample Prep

	SRM 2585 dust	SRM 1957 serum	Silicone bands
Preparation	NA	Reconstituted 2 vials with 10.7 mL DI water, shaking, vortexing	Rinse, conditioning, deployment in semi-rural outdoor environment 18 days
Quantity extracted	3 g dust unaltered 3 g dust spiked	9.75 mL unaltered 9.75 mL spiked	8 bands unaltered 8 bands spiked
Extraction and final solvent	Methanol	Cold acetonitrile, formic acid	Ethyl acetate,13 surrogates added
Extraction method	Vortex, sonication, centrifuge	Protein crash, vortex, centrifuge	Orbital shaker
Cleanup	LC-Si SPE cartridges	NA	NA
Evaporation	N_2 blowdown to 15 mL final volume	N_2 blowdown to 19.5 mL final volume	TurboVap to 12 mL final volume
Final samples	400 µL in 30 vials	400 µL in 30 vials	400 µL in 30 vials
Blank	Method blank	Method blank	Solvent blank

ENTACT Instrument Methods: GC + Other

Lab #	Chromatography	Mobile phase	MS type	MS/MS
1	Agilent GC×GC, Restek Rxi-5ms (30 m × 0.25 mm × 0.25 μm) + Restek Rxi-17Sil MS (0.6 m × 0.25 mm × 0.25 μm)	Helium	Leco HRT+ ToF in EI and CI for confirmation	NA
2	Agilent GC, Agilent J&W VF-5MS (30 m × 0.25 mm × 0.25 μm)	Helium	Agilent Triple Quad in EI	NA
3	Agilent GC, Agilent HP-5ms Ultra Inert (30 m × 0.25 mm × 0.25 μm)	Helium	Agilent ToF in EI	NA
4	Agilent GC×GC, Restek Rtx-5MS (35 m × 0.25 mm × 0.25 μm)+Restek Rxi-17 (0.79 m × 0.1 mm × 0.1 μm)	Helium	Leco Pegasus 4D	NA
9b	Direct infusion	NA	Thermo Velos Pro +21T FT-ICR in ESI +/-	NA

Ulrich EM, et al. (2019) *ABC* 411:853-866. doi:10.1007/s00216-018-1435-6

ENTACT Instrument Methods: LC-ToF

Lab #	Chromatography	Mobile phase	MS type	MS/MS
5	Agilent LC, Agilent Zorbax Eclipse Plus C8 (50 × 2.1 mm, 1.8 μm)	Water, methanol, ammonium formate (AF)	Agilent 6530 QToF, ESI +/-	Data dependent 10, 20, 40 collision
6	Agilent LC, ZORBAX Eclipse Plus C18 (100 × 2.1 mm, 1.8 μm)	Water, methanol, ammonium acetate, acetic acid	Agilent 6530 QToF, ESI +/-	Data dependent 10, 20, 40 collision
7	Agilent LC, Agilent Zorbax RRHD Eclipse Plus C18 (150 × 2.1 mm, 1.8 μm)	Water, acetonitrile, formic acid (FA)	Agilent 6550 QToF, ESI +/-	Data dependent 10, 20, 40 collision
8	Agilent LC, Agilent Zorbax Eclipse Plus C18 (100 × 2.1 mm, 1.8 μm)	Water, methanol, ammonium acetate	Agilent 6550 QToF, ESI +/-	Data dependent 10, 20, 40 collision
9a	Direct infusion	NA	Agilent 6560 QToF, nESI +/- & APPI +/-	NA, but drift tube ion mobility spectrometry
10	Dionex LC, Waters XSelect HSS T3 (150 × 3 mm, 3.5 μm)	Water, acetonitrile, FA	Bruker maXis II TOF, ESI+, Bruker maXis II UHR QToF in ESI+	Data dependent 35 collision energy
11	Waters LC, ACQUITY UPLC BEH C18 (50 × 2.1 mm,1.7 μm)	Water, methanol, AF	Waters Xevo G2-XS QToF in ESI +/-	Data independent, Low = 4, High = ramp 10-45

Ulrich EM, et al. (2019) *ABC* 411:853-866. doi:10.1007/s00216-018-1435-6

ENTACT Instrument Methods: LC-Orbitrap

Lab #	Chromatography	Mobile phase	MS type	MS/MS
12a	Direct infusion	NA	Thermo Orbitrap Elite in nESI +/-	NA
12b	Thermo LC, Thermo Accucore C30 (150 × 2.1 mm, 2.6 μm)	Water, acetonitrile, isopropanol, AF, FA	Thermo Q Exactive in HESI +/-	Data dependent 30, 60 collision
13	Dionex LC, MAC-MOD Analytical ACE Excel C18-PFP (125 × 3 mm, 2 μm)	Water, acetonitrile, FA or ammonium hydroxide	Thermo Q Exactive in ESI +/-, APCI +/-	Data dependent 15, 30, 45 collision
14	Dionex LC, Waters XBridge BEH C18 (50 ×2.1 mm, 3.5 μm)	Water, methanol, FA	Thermo Q Exactive in HESI +/-	Data dependent, 50 collision varied by *m/z*
15	Thermo LC, Thermo Hypersil GOLD aQ C18 Polar Endcapped (100 × 2.1 mm, 1.9 μm)	Water, acetonitrile, FA	Thermo Q Exactive in HESI +/-	Data independent, stepped 30
16	Dionex LC, Waters Atlantis T3 (150 × 3 mm, 3 μm)	Water, methanol, isopropanol, FA	Thermo Q Exactive Plus in ESI +/-	Data Independent, varies 15-120; Dependent 20, 50, 90
17	Waters LC, Thermo Hypersil Gold aQ C18 Polar Endcapped (200 ×2.1 mm, 1.9 μm)	Water, methanol, FA, AF	Thermo Q Exactive Plus in HESI +/-, APCI +/-	NA

Ulrich EM, et al. (2019) *ABC* 411:853-866. doi:10.1007/s00216-018-1435-6

ENTACT Initial Results: Mixtures

Actual	499 Mix 1 95	500 Mix 2 95	501 Mix 3 95	502 Mix 4 95	503 Mix 5 185	504 Mix 6 185	505 Mix 7 365	506 Mix 8 365	507 Mix 9 95	508 Mix 10 365
1	128	148	166	187	292	269	318	470	177	410
2	142	154	102	129	250	242	401	399	105	452
3	48	40	48	59	110	101	97	130	37	109
4	72	71	63	70	136	125	273	313	49	265
5	301	130	375	341	408	404	719	687	198	327
6	65	66	74	72	105	118	193	215	54	162
7	587	552	596	554	798	846	1327	1274	509	1176
8	93	114	116	106	182	201	360	374	73	330
9	337	372	303	365	321	363	466	505	510	463
10	135	130	125	154	188	195	284	295	100	153
11	70	57	64	66	105	115	176	125	35	159
12a	595	486	571	630	746	669	899	910	588	792
12b	66	170	51	41	272	116	214	101	163	404
13	51	37	35	39	74	59	124	109	42	105
14	137	65	45	74	68	234	413	408	120	317
15	215	249	212	249	207	275	245	254	140	253
16	1298	1258	1304	1209	1651	1641	2520	2538	1202	2193
17	153	217	221	199	254	321	523	651	496	396

Reported vs Actual

<75%	59/180
>75 to <125%	34/180
>125%	87/180

True Positive Rates (TPR)

				Blinded Results			Unblinded Results		
Mix	Spiked Substances	Spiked Isomers	Spiked Isobars	True Positives	TPR	Adj. TPR	True Positives	TPR	Adj. TPR
1	95	2	2	33	0.35	0.35	46	0.48	0.49
2	95	2	2	12 (35)	0.13 (0.37)	0.13 (0.38)	19 (53)	0.20 (0.56)	0.20 (0.57)
3	95	0	0	26	0.27	0.27	47	0.49	0.49
4	95	0	0	44 (36)	0.46 (0.38)	0.46 (0.38)	58 (58)	0.61 (0.61)	0.61 (0.61)
5	185	2	4	66	0.36	0.36	103	0.56	0.56
6	185	2	2	81	0.44	0.44	103	0.56	0.56
7	365	18	26	156	0.43	0.45	225	0.62	0.65
8	365	2	6	144	0.39	0.40	195	0.53	0.54
9	95	52	67	18	0.19	0.42	19	0.20	0.44
10	364	207	257	19 (80)	0.05 (0.22)	0.12 (0.51)	31 (107)	0.09 (0.29)	0.20 (0.68)

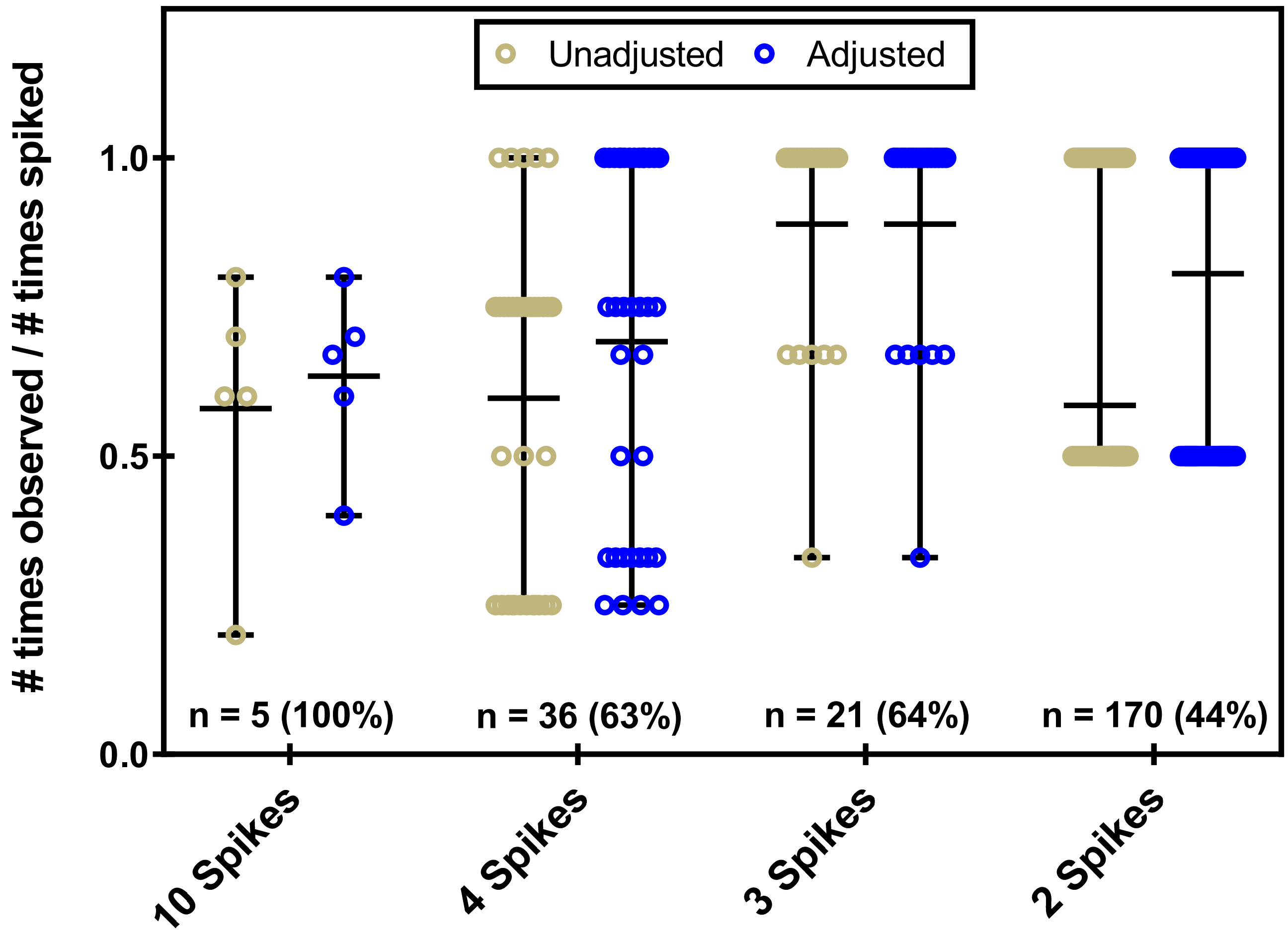
Note: results in ( ) are based on a 2nd analysis using altered methods (ACN vs. MeOH)

How good are we?

How good can we be?

Sobus JR, et al. (2019) *ABC* 411 (4):835-851. doi:10.1007/s00216-018-1526-4

Reproducibility of Results



 # Times Observed / # Times Spiked:

Global Unadj. = 62%

Global Adj. = 75%

1 → spiked 11 times

4 → spiked 10 times

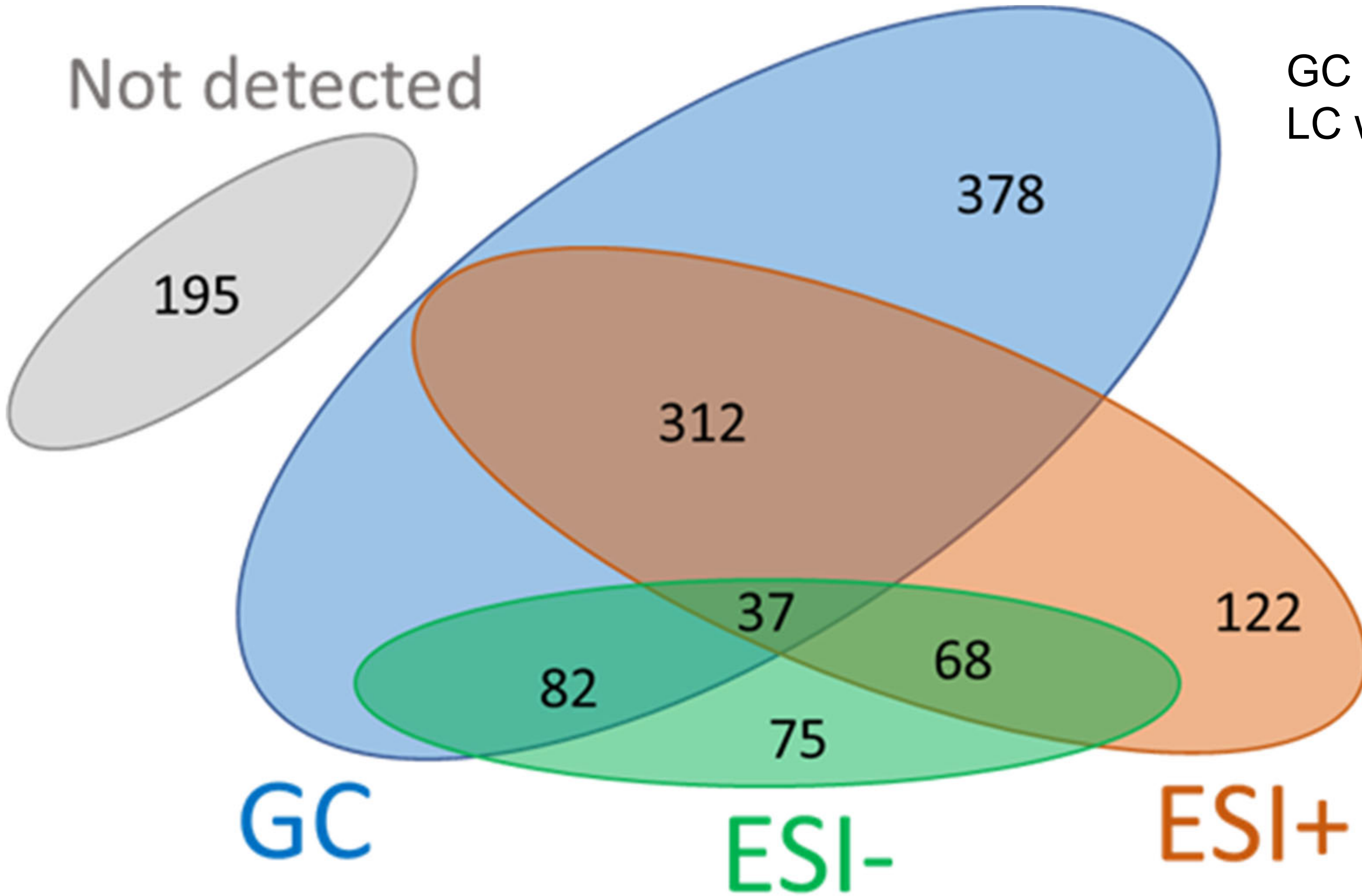
57 → spiked 4 times

33 → spiked 3 times

388 → spiked 2 times

Sobus JR, et al. (2019) *ABC* 411 (4):835-851. doi:10.1007/s00216-018-1526-4

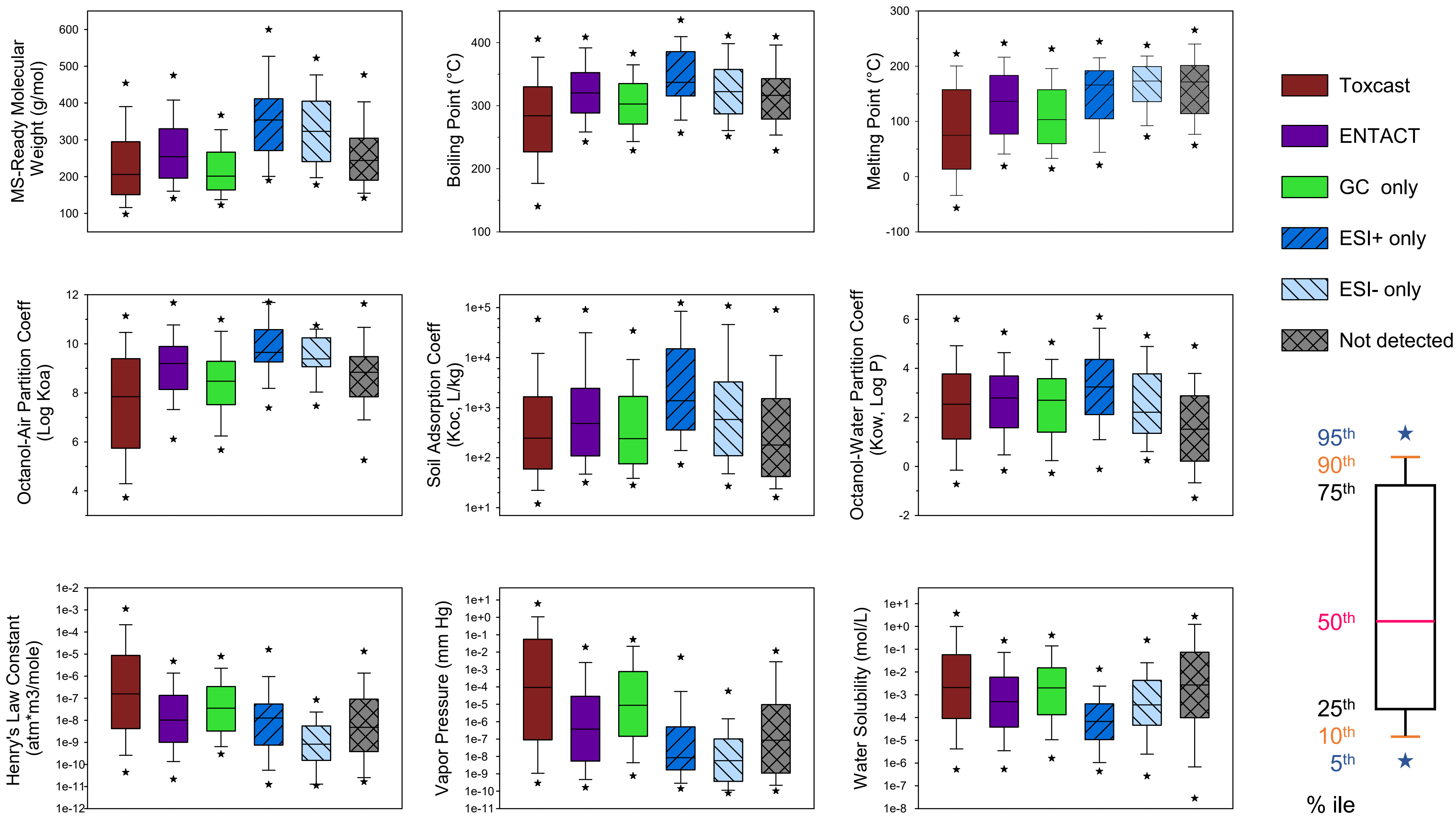
ENTACT Initial Results: Method Coverage



GC with electron impact
LC with electrospray +/-

Ulrich EM, et al. (2019) *ABC* 411:853-866. doi:10.1007/s00216-018-1435-6

ENTACT Initial Results: Chemical Space



ENTACT Initial Results: Multimedia Samples

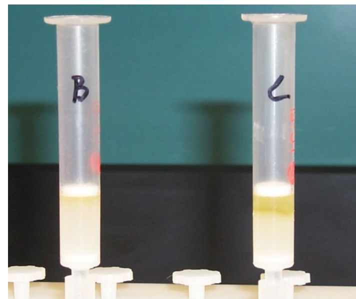
Actual	Dust ?	Fort. Dust 365	Serum ?	Fort. Serum 95	Band ?	Fort. Band 185
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	923	1026	-	-	616	680
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	87	236	31	92	46	124
9	277	259	206	222	243	313
10	150	270	31	54	58	101
11	-	-	-	-	-	-
12a	917	1009	638	614	-	-
12b	772	861	94	145	298	557
13	120	124	41	52	24	76
14	188	389	90	178	100	88
15	-	-	-	-	-	-
16	-	-	-	-	-	-
17	-	-	-	-	-	-

<75%	10/54
>75 to <125%	2/54
>125%	10/54
- not reported	32/54

Dust Spiking Experiment

A. ENTACT and **B.** 4× dust spiked before extraction

Sonication
Methanol



Silica > Methanol

C. Extract Spike

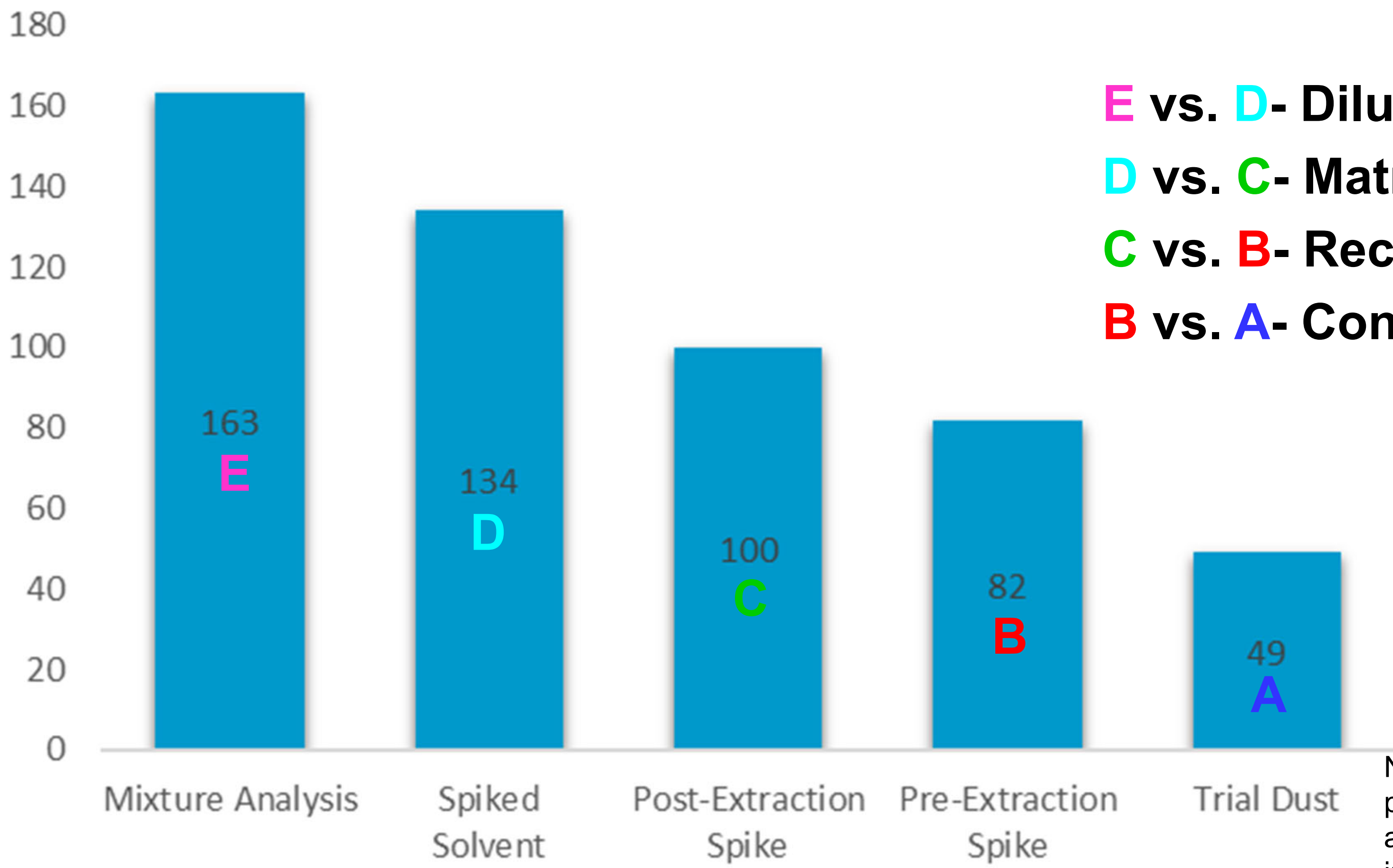
A vs. B- Concentration issues
B vs. C- Recovery
C vs. D- Matrix suppression
D vs. E- Dilution issues

E. ENTACT mixture

D. Solvent spike

Newton, S. et al., "Examining NTA performance and potential using fortified and reference house dust as part ENTACT," in preparation for ABC.

Losses at Each Stage
Mixture Analysis vs. Spiked Solvent



E vs. D- Dilution issues (29)

D vs. C- Matrix suppression (34)

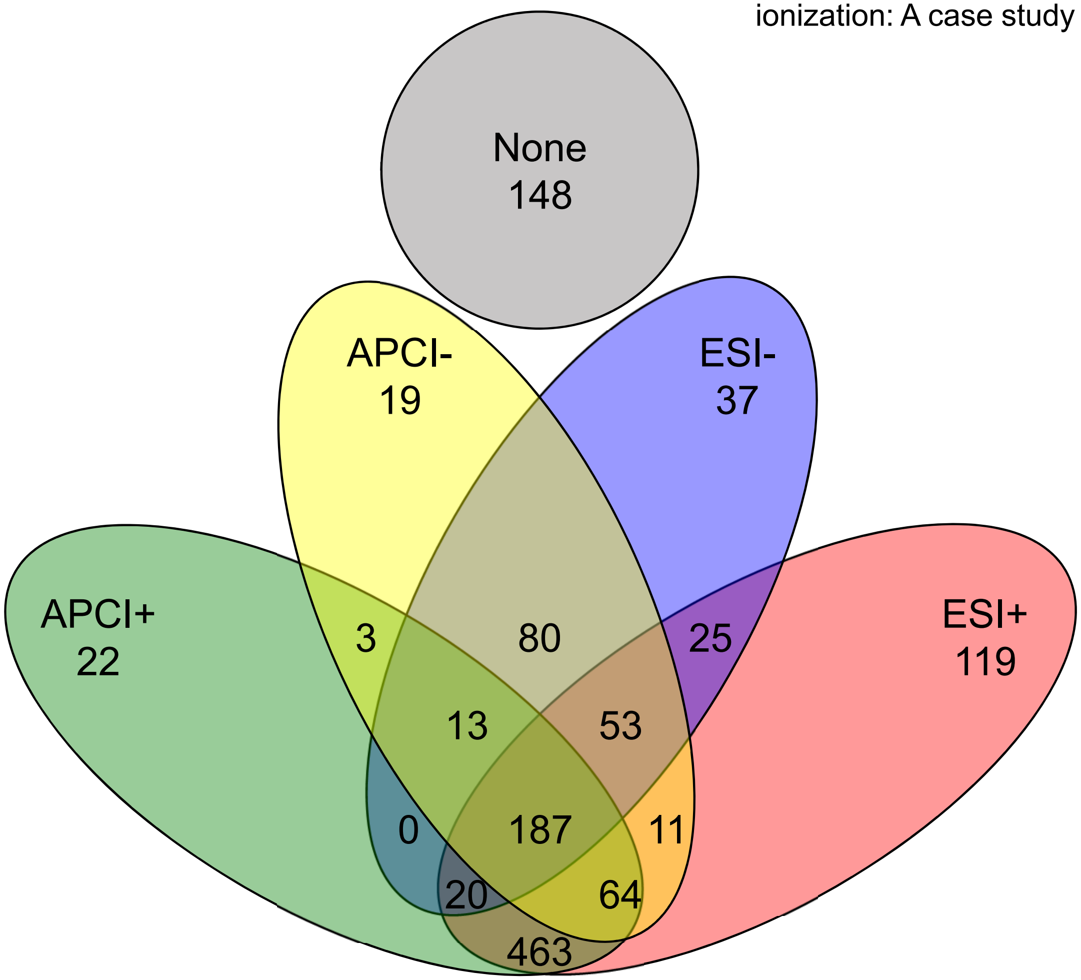
C vs. B- Recovery (18)

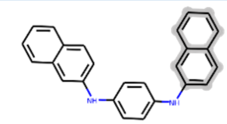
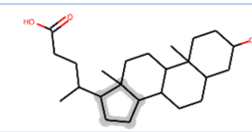
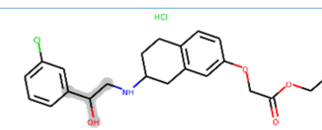
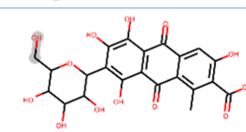
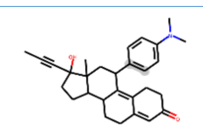
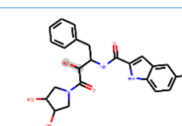
B vs. A- Concentration issues (33)

Newton, S.R. et al., “Examining NTA performance and potential using fortified and reference house dust as part ENTACT,” in preparation for ABC.

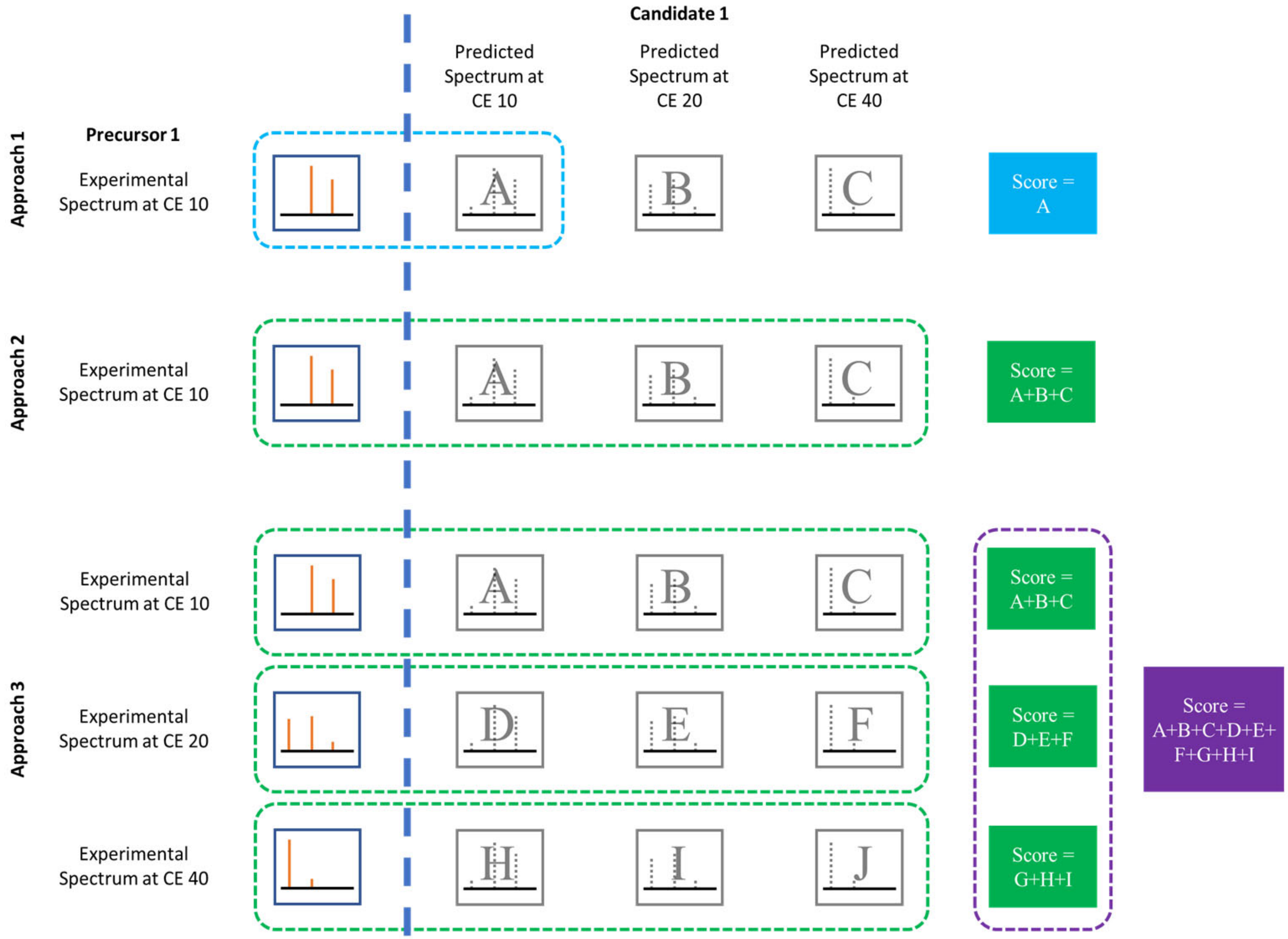
ENTACT LC Ionization Comparison

Singh, R.R. et al., “Expanded coverage of NT-LC-HRMS using atmospheric pressure chemical ionization: A case study with ENTACT mixtures,” in preparation for ABC.



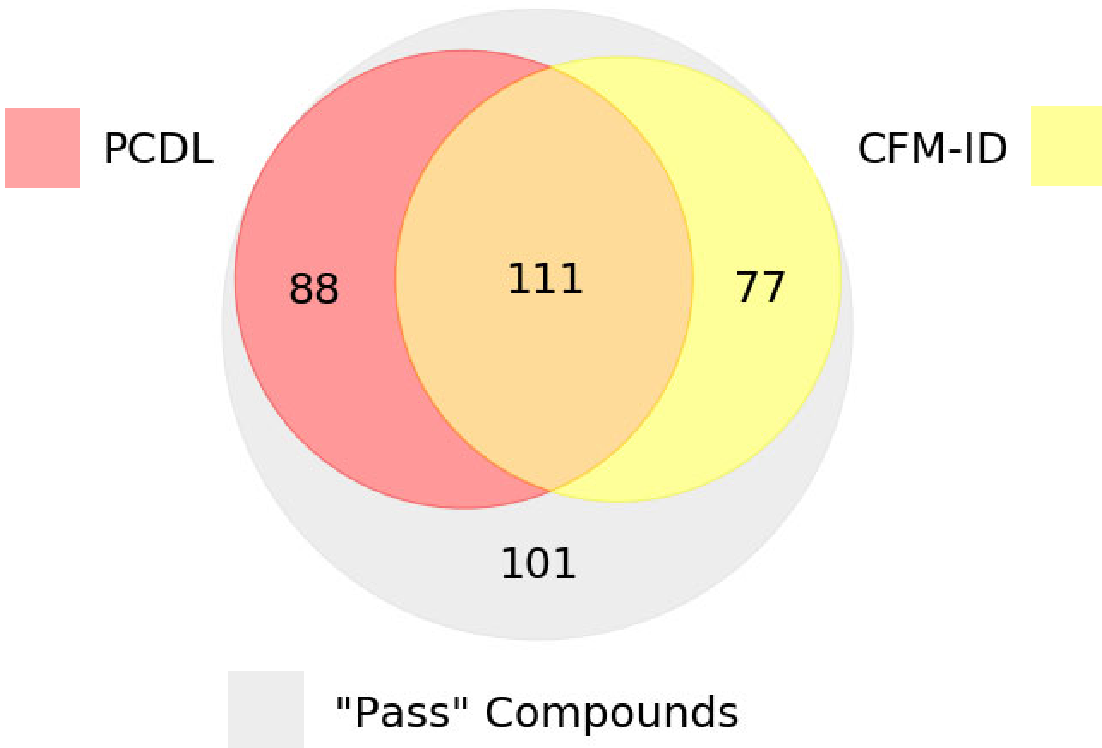
ToxPrint Substructure	Odds ratio	Structure with ToxPrint
ring:fused_[6_6]_naphthalene (APCI)	7.607	
chain:alkaneCyclic_pentyl_C5	∞	
chain:alkaneLinear_hexyl_C6 and _octyl_C8	∞	
bond:COH_alcohol_sec-alkyl	8.543	
bond:COH_alcohol_pri-alkyl	6.891	
chain:alkaneCyclic_ethyl_C2_(connect_noZ)	6.891	
bond:COH_alcohol_generic	3.256	

In silico fragmentation: CFM-ID Scoring



Chao, A., “In silico MS/MS spectra for identifying unknowns: A critical examination using CFM-ID algorithms and ENTACT mixture samples,” submitted to ABC.

Reference vs. CFM-ID Libraries



	% Compounds IDed
PCDL	53%
CFM-ID Top 1 Hit	50%
PCDL + CFM-ID Top 1 Hit	73%

Chao, A., "In silico MS/MS spectra for identifying unknowns: A critical examination Using CFM-ID algorithms and ENTACT mixture samples," submitted to ABC.

ENTACT Summary and Future Work

- # features in mixtures >> intentionally added substances
- 195 substances not detected by GC or LC-ESI methods, 37 detected by all
- EPA true positive rate 12-45% blinded and 20-65% unblinded
- Environmental samples more complex, losses for multiple reasons
- APCI complementary to ESI, ToxPrints help predict ionization mode success
- CFM-ID MS2 spectra predicted for DSSTox at 3 LC/ESI energies + GC/EI
- Unblinded performance for CFM-ID
  - 34% (without formula filtering), 50% (with formula filtering) identified as the top hit
  - 73% of compounds identified by reference library match or as the top hit (formula filtering)
- Additional work on serum and bands
- Adding GC-Orbitrap and GC-QTOF to cover more volatile chemical space
- Cross laboratory comparison coming soon

Outline

- **EPA's Non-Targeted Analysis Collaborative Trial (ENTACT)**
  - About NTA and ENTACT
  - Initial results
  - APCI vs ESI
  - Predicted mass spectra
- **Applications of NTA to house dust**
- **Existing tools and future plans for UVCBs**
- **Benchmarks and Publications for Non-Targeted Analysis**

Children’s Exposure: Introduction

Background:

- Dust is an important route of exposure, especially for children
- Non-targeted analysis (NTA) to understand the exposome (including non-chemical stressors)
- Non-chemical stressors include stressors from the built, natural, and social environments
  - Built- building materials, pest problems
  - Social- dietary habits, technology access
  - Natural- access to/use of natural environment

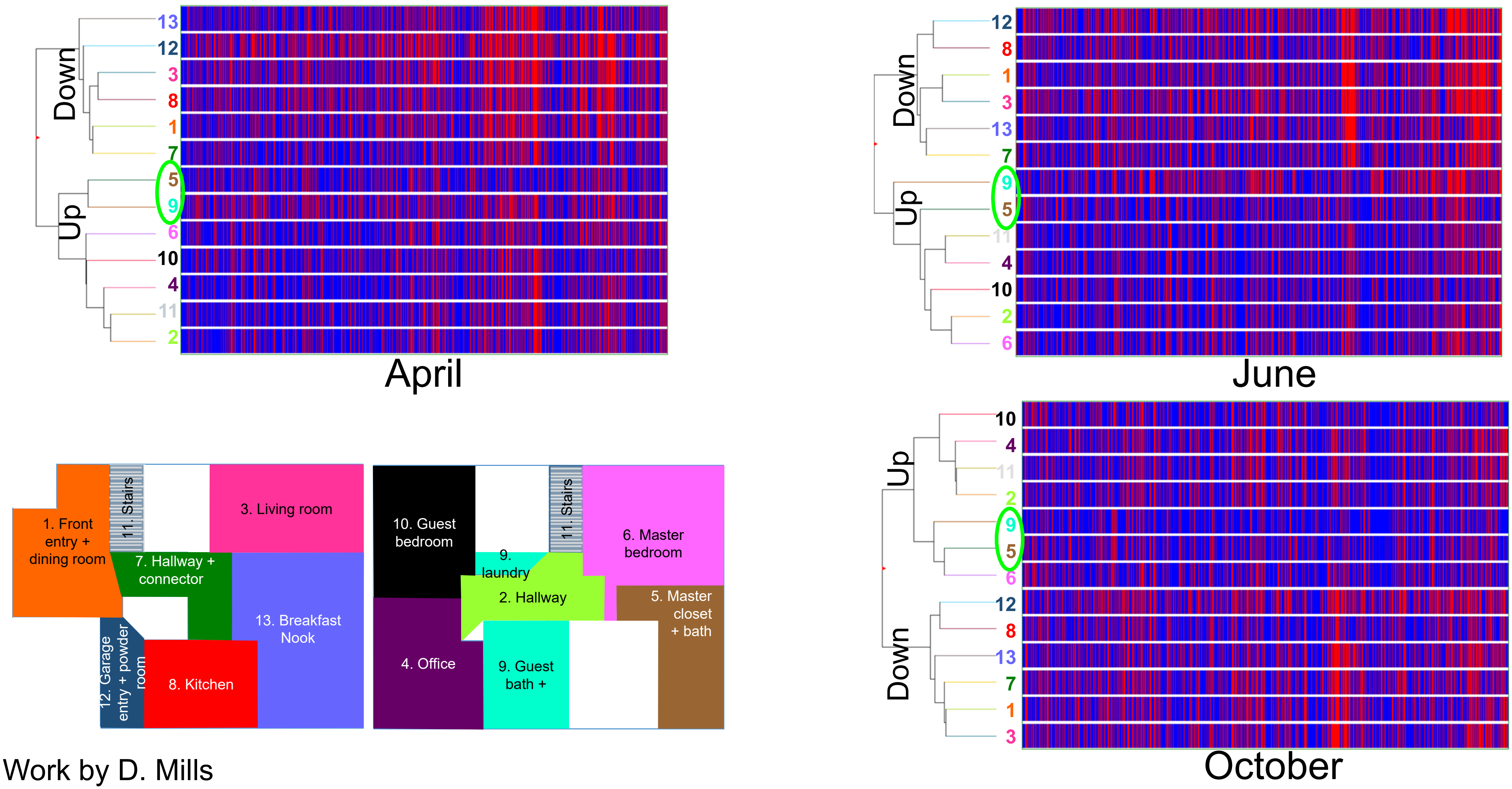
Goal: Understand factors affecting exposure to stressors using dust

Objectives:

- Explore variability within NTA dust results from: Time (April, June, October); Room (N = 13); Size fraction (<150 μm, 150 μm - 1mm); Extraction reps (N =3); Analysis reps (N = 3)
- Identify differences between dust in homes with (N = 5) and without (N = 4) children
- Identify chemical indicators of non-chemical stressors

Work by D. Mills

Single Home Variability Study- Clustering

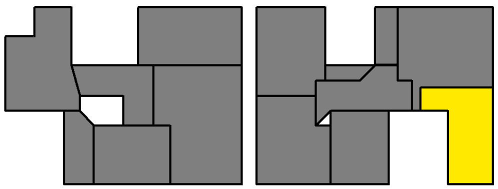


Work by D. Mills

Chemical Patterns

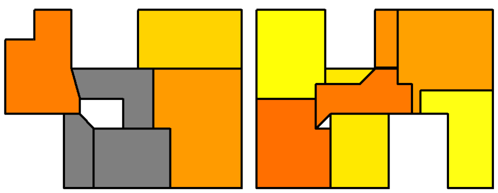
Master Bath only- PCP?

849.2411@19.12



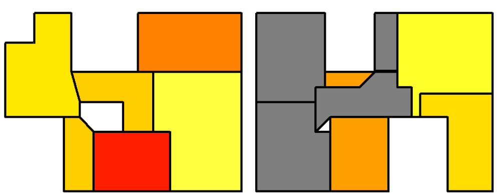
Termiticide (doorways), flea top spot (dog)

Fipronil

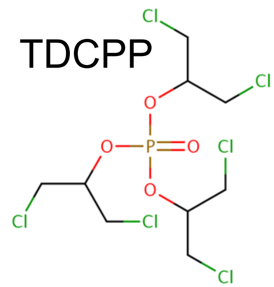


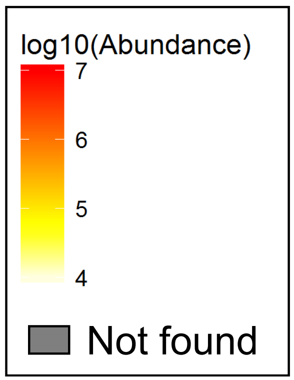
Black pepper- KITCHEN!

Piperine

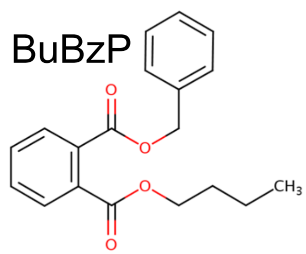


TDCPP





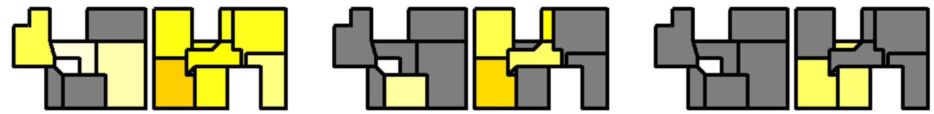
BuBzP



TDCPP

Flame retardant in PUF, dissipating?

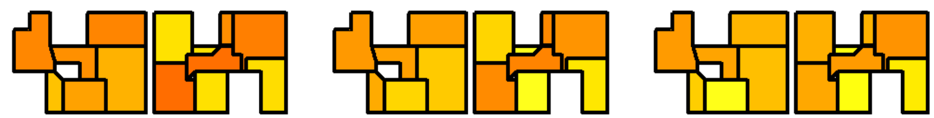
1 2 3



Pyriproxyfen

Similar pattern at all time points, dog?

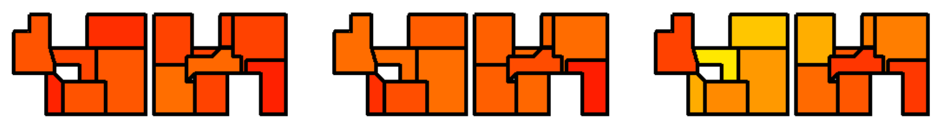
1 2 3



Butylbenzylphthalate

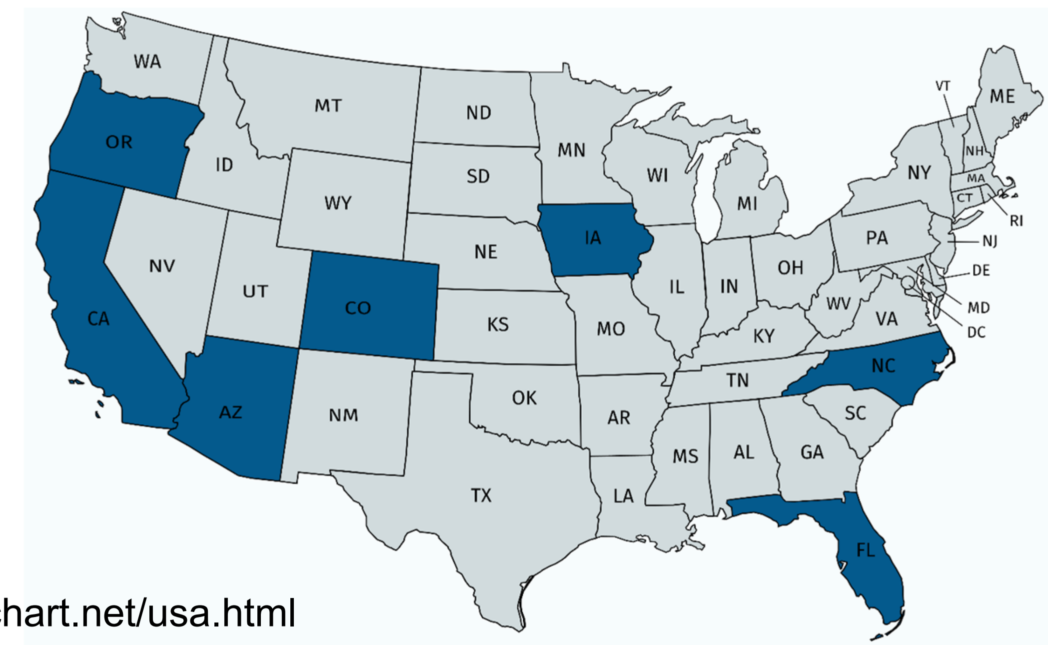
It's everywhere! Construction materials?

1 2 3



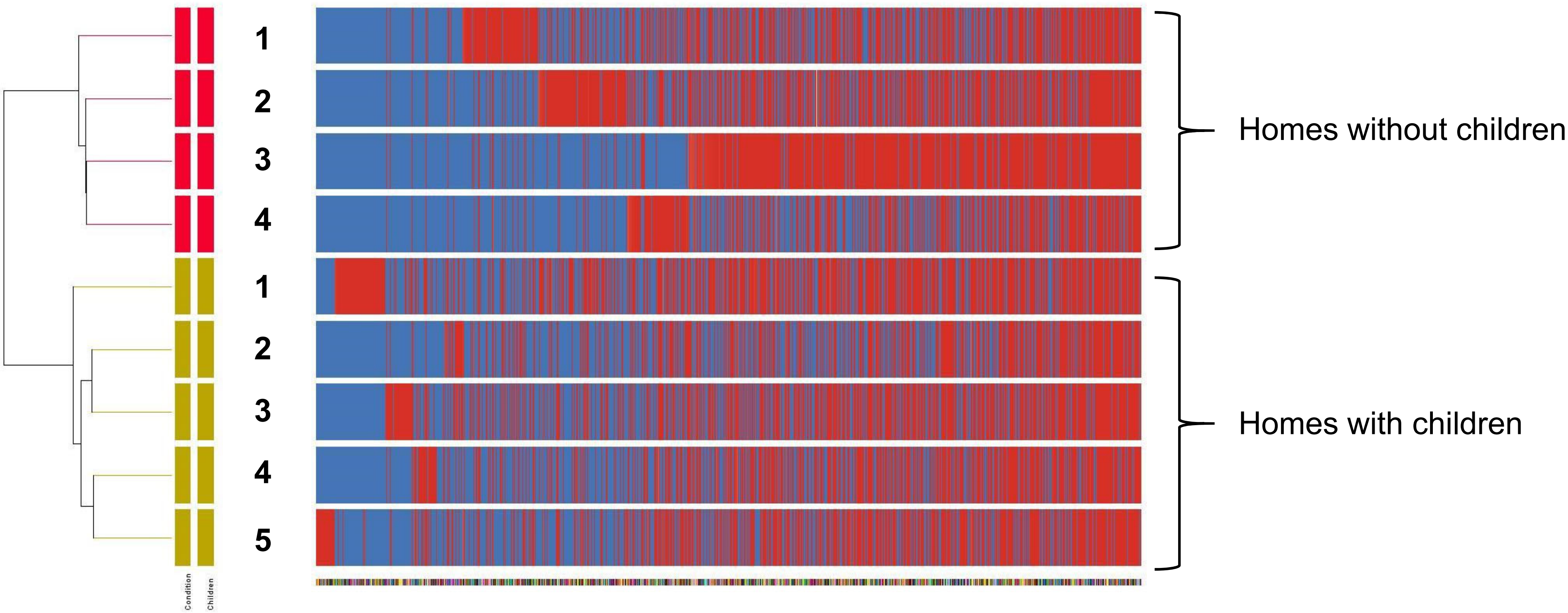
House Dust with Children vs. No-children

- Samples collected by homeowners using own vacuum in entire home
- Number of children varied from 1-4
- Ages ranged from 3.5 months to 18 years old at time of dust collection
- 5 homes had dogs, 1 home had cats, 3 homes had no pets (N = 9)
- Samples from a variety of states



mapchart.net/usa.html

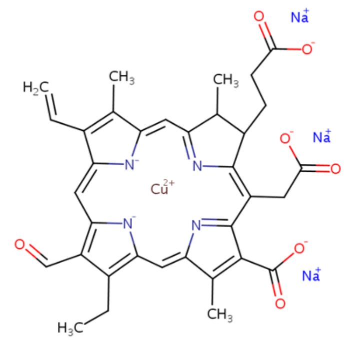
Children vs. No-children- Clustering



Work by D. Mills

House Dust with Children vs. No-children- Differences

- Unique to homes with children (5/5)
  - Sodium copper chlorophyllin:
  - Found mainly personal care products (PCPs)



- Increased abundance in homes with children
  - Caffeine: <u>1551</u> Fold Change (FC)
  - Oleic acid: fats & oils, PCPs, soaps, fragrances <u>16 FC</u>
  - TDCPP: flame retardant, pesticide <u>23 FC</u>
  - Bis(2-ethylhexyl) decanedioate: plasticizer used in PCPs/toys <u>60 FC</u>

Work by D. Mills

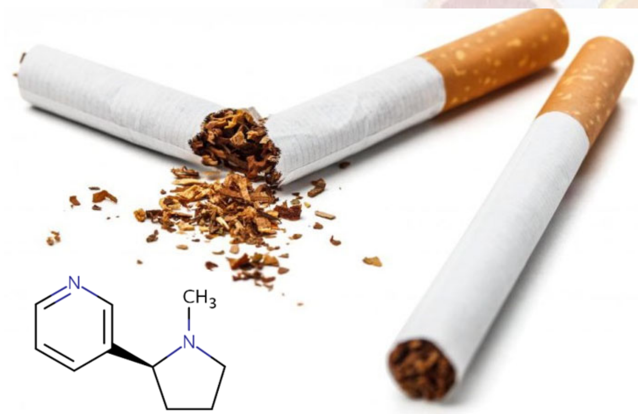
Images from: www.srnutrachem.cn/productgrouplist-802498034/Herb.html
www.irishtimes.com/life-and-style/health-family/caffeine-view-it-as-a-potent-drug-1.1891374

House Dust with Children vs. No-children

Chemical indicators of non-chemical stressors:

- Diet/eating practices:
  - Hesperidin: found in citrus fruits
  - Mauritianin: found in cereal/cereal products
- Cigarette smoking:
  - Nicotine
- Outdoor time:
  - Umbelliferone: used in sunscreen
- Access to medicine:
  - Vancomycin: antibiotic
  - Pimecrolimus: eczema

Note: Some chemicals tentatively identified



Images from: www.southcrop.org/food-trends/tobacco-stocks-plunge-after-fda-proposes-nicotine-cuts/
www.webmd.com/drugs/2/drug-8858/vancomycin-oral/details

Applications of NTA to Indoor Dust- Summary

Single home variability study

- Less variability across extraction replicates than rooms (as expected)
- More variability for large particles
- Spatial patterns possibly indicative of chemical use; patterns inconsistent between time points
- At higher level, floors cluster together; hierarchical clusters inconsistent between time points

Non-chemical stressors in homes with/without children

- Dust from homes cluster based on whether children inhabit home
- There are features that are unique to homes with children; some features enriched
- Chemical indicators of diet, outdoor activity, smoking, health care non-chemical stressors detected (identities not confirmed)

Outline

- **EPA's Non-Targeted Analysis Collaborative Trial (ENTACT)**
  - About NTA and ENTACT
  - Initial results
  - APCI vs ESI
  - Predicted mass spectra
- **Applications of NTA to house dust**
- **Existing tools and future plans for UVCBs**
- **Benchmarks and Publications for Non-Targeted Analysis**

Understanding Exposure to UVCBs

Problem

Many commercial products are or contain chemical substances of unknown or variable composition (UVCB) with no definite molecular formula. UVCB substances generally cannot be characterized using existing chemical exposure estimation methods. Thus, new methods are needed to further categorize and characterize UVCB exposure.

Actions and Outputs

- Enumerate UVCB chemical structures and add them to databases
- Data processing tools- Kendrick Mass Defect analyses, envihomolog (Eawag), others?
- NTA of UVCBs- identification, fingerprints, composition, and classification models
  - Potential candidates: Palm oil, beeswax, chloro-paraffin and hydrocarbon waxes, kerosine, eucalyptus oil
- EDA of UVCBs- AOPs, identification, exposure models

United States Environmental Protection Agency

Home | Advanced Search | Batch Search | Lists | Predictions | Downloads | Copy | Share | Submit Comment | Search all data

Palm oil

8002-75-3 | DTXSID2027674

Searched by Approved Name.

- DETAILS
- RELATED SUBSTANCES
- SYNONYMS
- LINKS
- BIOACTIVITY
- EXPOSURE
- HAZARD
- COMMENTS
- PROPERTIES
- LITERATURE

Presence in Lists

Federal

LIST:Hazardous Substances Data Bank | EPA: High Production Volume List | EPA: Toxicity Values Version 5 (Aug 2018)

US State

None.

International

None.

Other

EPA|ENDOCRINE: Endocrine Disruptor Screening Program (EDSP) Universe of Chemicals | EPA|TSCA: TSCA Inventory, active non-confidential portion

EPA|CPDAT: Chemical and Products Database

Record Information

Citation: U.S. Environmental Protection Agency. Chemistry Dashboard. https://comptox.epa.gov/dashboard/DTXSID2027674 (accessed May 31st, 2019), Palm oil

Data Quality:

Level 1: Expert curated, highest confidence in accuracy and consistency of unique chemical identifiers

Level 2: Expert curated, unique chemical identifiers using multiple sources

Level 3: Programmatically curated from high quality EPA source, unique chemical identifiers have no conflicts in ChemID and PubChem

Level 4: Programmatically curated from ChemID, unique chemical identifiers have no conflicts in PubChem

Level 5: Programmatically curated from ACToR or PubChem, unique chemical identifiers with low confidence, single public source

Quality Control Notes

https://comptox.epa.gov/dashboard/
A. Williams

Enumeration of UVCBs

- Generating base case SMILES in RChemMass
- https://github.com/schymane/RChemMass/

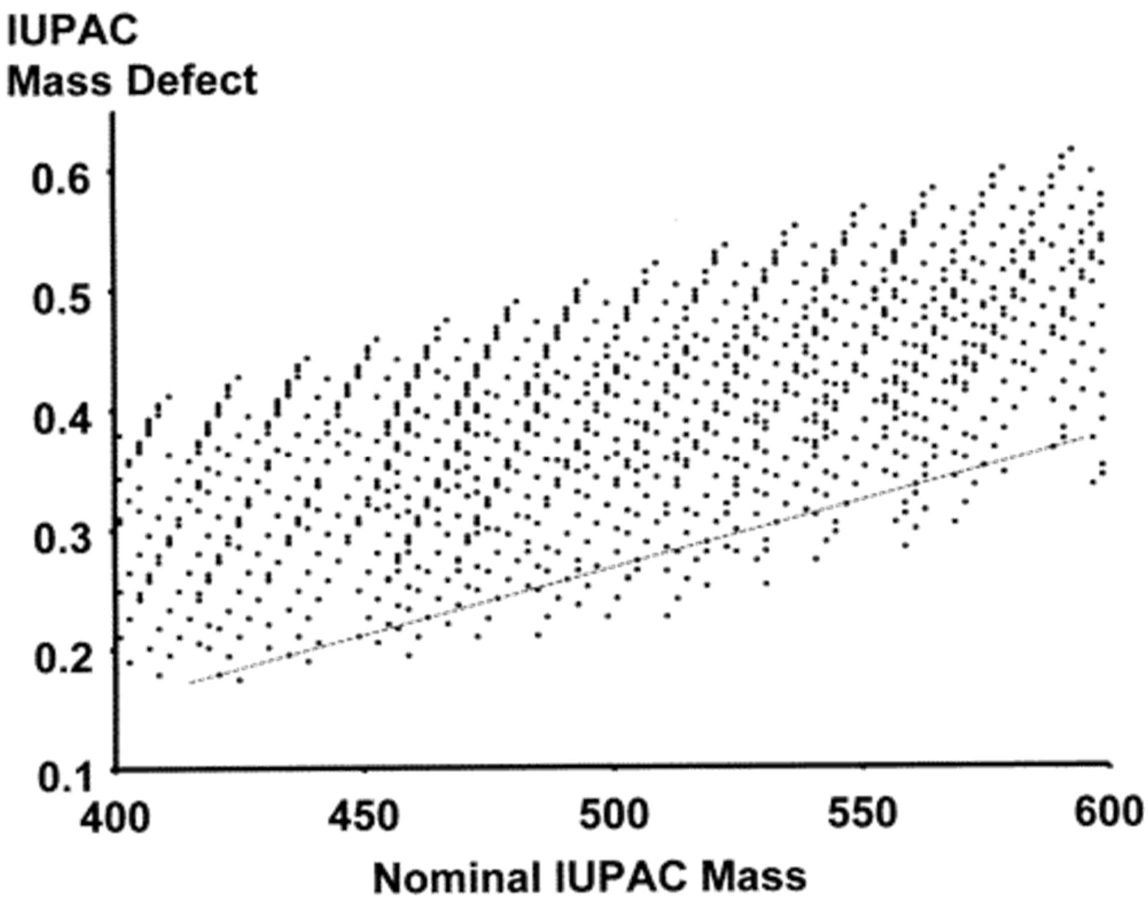
```r
# try with one 1,2 variant
genSmiles12PPG1 <- "[R]O"
R1toN_12PPG1 <- "(OC(C)C)"
nR1toN_PPG <- "(0-15)"

smiles_12PPG1_0to16 <- buildSmiles(genSmilesPPG,R1toN_12PPG1,nR1toN_PPG)
smiles_12PPG1_0to16
write.table(smiles_12PPG1_0to16,"smiles_12PPG1_0to16.txt",row.names = F, col.names = F,quote = F)

```

```
> smiles_12PPG1_0to16 <- buildSmiles(genSmilesPPG,R1toN_12PPG1,nR1toN_PPG)
> smiles_12PPG1_0to16
 [1] "OC(C)CO"
 [2] "OC(C)COC(C)CO"
 [3] "OC(C)COC(C)COC(C)CO"
 [4] "OC(C)COC(C)COC(C)COC(C)CO"
 [5] "OC(C)COC(C)COC(C)COC(C)COC(C)CO"
 [6] "OC(C)COC(C)COC(C)COC(C)COC(C)COC(C)CO"
 [7] "OC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)CO"
 [8] "OC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)CO"
 [9] "OC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)CO"
[10] "OC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)CO"
[11] "OC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)CO"
[12] "OC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)CO"
[13] "OC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)CO"
[14] "OC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)CO"
[15] "OC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)CO"
[16] "OC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)COC(C)CO"
```

Kendrick Mass Defect Plots



Plot of IUPAC mass defect vs nominal IUPAC mass for ions of *odd* nominal mass

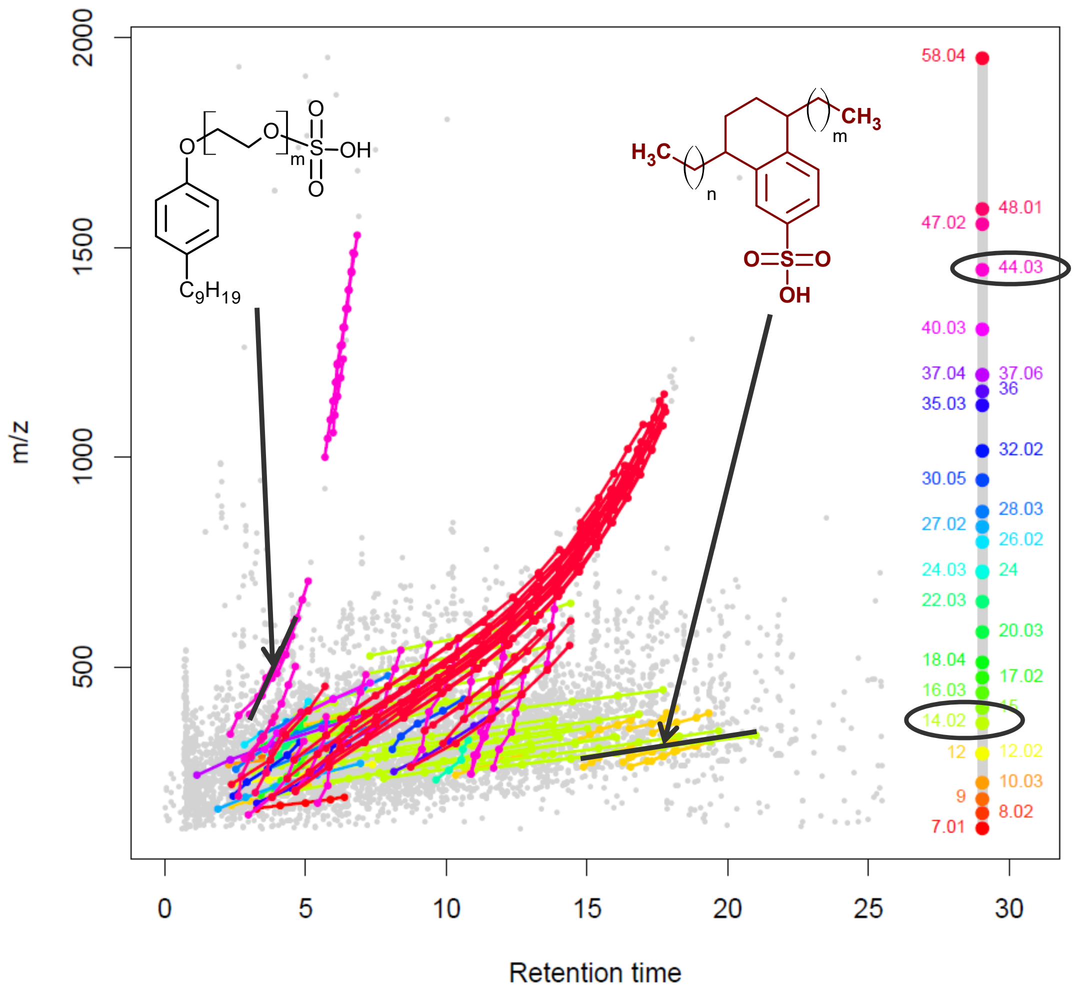
On the nominal mass axis:
Periodicity of 2 Da (H_2, rings + double bonds)
Periodicity of 14 Da (CH_2, chain length)

On the mass defect axis:
Periodicity of 0.015 65 Da (H_2)

These spacings make it possible to determine molecular "class" and "type" simultaneously over a wide mass range from a single display

Hughey CA, et al. (2001) *Analytical Chemistry,* 73 (19):4676-4681. doi:10.1021/ac010560w

Homologous Series and UVCBs in samples



eawag
aquatic research

nontarget

R

http://www.envihomolog.eawag.ch/

E. Schymanski et al. 2014, *ES&T*
DOI: 10.1021/es4044374

M. Loos & H. Singer, 2017. *J. Cheminf.*
DOI: 10.1186/s13321-017-0197-z

Outline

- **EPA's Non-Targeted Analysis Collaborative Trial (ENTACT)**
  - About NTA and ENTACT
  - Initial results
  - APCI vs ESI
  - Predicted mass spectra
- **Applications of NTA to house dust**
- **Existing tools and future plans for UVCBs**
- **Benchmarks and Publications for Non-Targeted Analysis**

Benchmarking and Publications for Non-targeted Analysis (BP4NTA)

A diverse working group consisting of representatives from all sectors dedicated to improving NTA through benchmark methods and performance, standardized definitions and publication standards.

Join us! Informational mtg at SETAC Toronto

Monday, November 4 @ 2:15pm, Rm 703 or phone

Contact Ben Place (benjamin.place@nist.gov) or Elin Ulrich (ulrich.elin@epa.gov) for more information