Biomonitoring California: The Task Ahead

Thomas F. Webster
Professor of Environmental Health
BUSPH

BOSTON UNIVERSITY
SCHOOL OF
PUBLIC HEALTH

Biomonitoring California Scientific Guidance Panel Meeting
8 March 2017
Sacramento

Fundamental task: exposure surveillance

- trends
- emerging compounds
- evaluate interventions
- geographical differences
- vulnerable groups
- …

There are many reasons to use biomonitoring for this purpose.

Other potential uses:

- e.g., support epidemiology & exposure studies

A number of issues, e.g.:

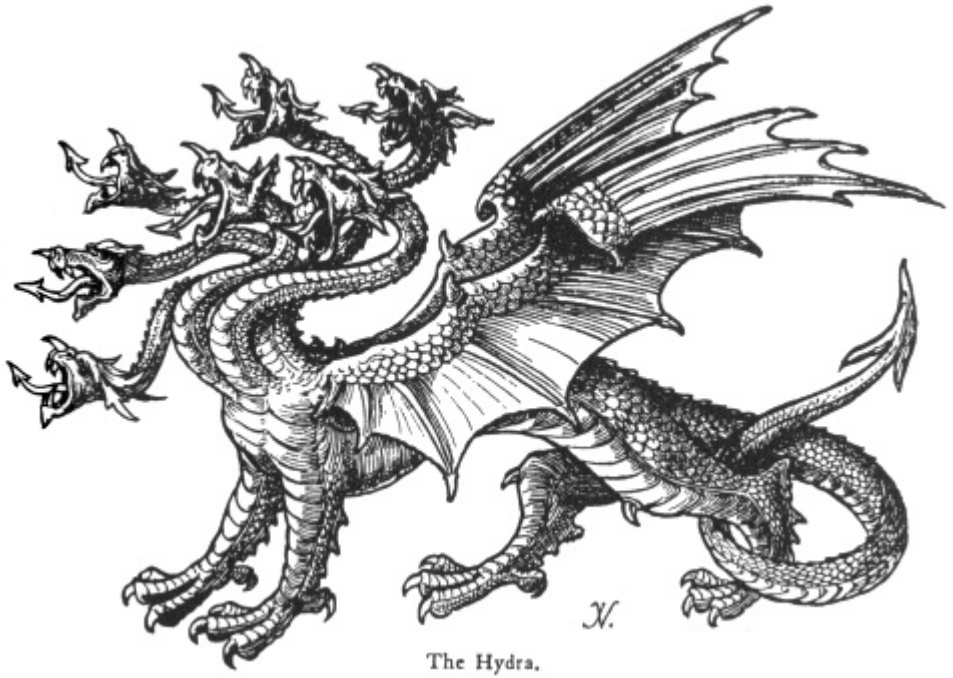
- Who to sample?
- which compounds to target?

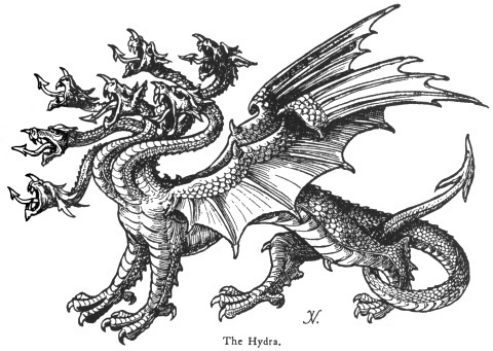
Which compounds to target?

A daunting task:

- ~10^5 chemicals in commerce (+ by-products, metabolites…)
- relatively poor information about production volume, uses, toxicity, sometimes even identity, etc.
- moving target (& cycle appears to be accelerating)

In a rational world, I think we should have this information, alternatives assessment (and analytical standards) prior to mass production



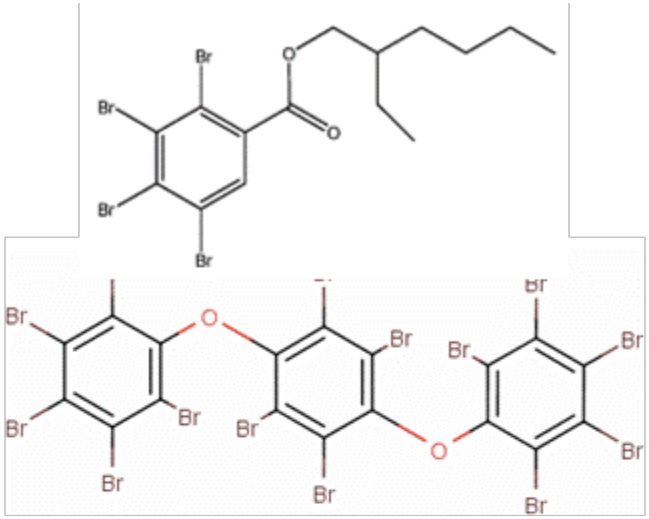


Flame retardants

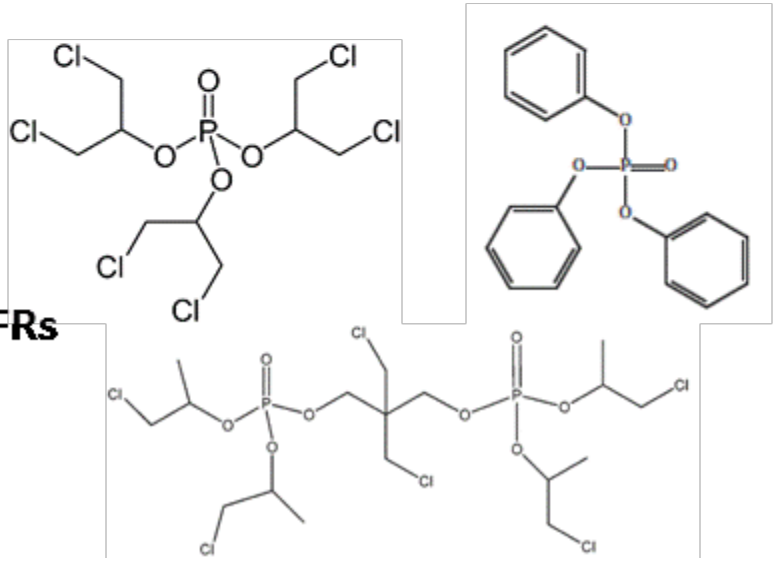
PBDEs

foam,
electronics

other BFRs



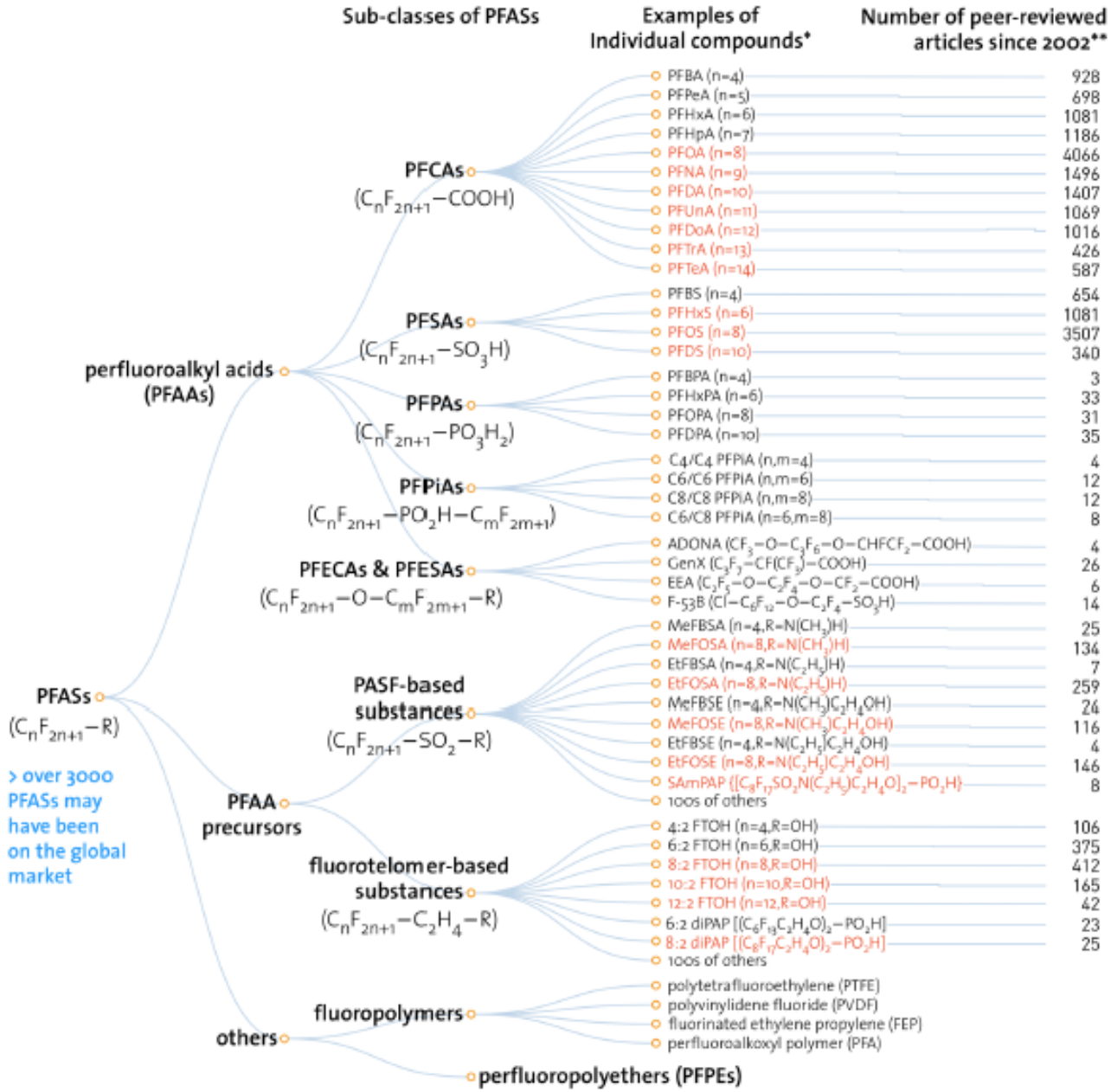
PFRs



& photolytic breakdown products (Su et al. ES&T 2016)

PFAS "A Never-Ending Story?"

water soluble
bind protein
precursors



Wang et al. ES&T 2017.

Which compounds to target?

Perspectives | Brief Communication

Identifying Chemical Groups for Biomonitoring

http://dx.doi.org/10.1289/EHP537

SUMMARY: Regulatory agencies face daunting challenges identifying emerging chemical hazards because of the large number of chemicals in commerce and limited data on exposure and toxicology. Evaluating one chemical at a time is inefficient and can lead to replacement with uncharacterized chemicals or chemicals with structural features already linked to toxicity. The Office of Environmental Health Hazard Assessment (OEHHA) has developed a process for constructing and assessing chemical groups for potential biomonitoring in California. We screen for chemicals with significant exposure potential and propose possible chemical groups, based on structure and function.

Krowech et al. *EHP* 2016

Reasonable approach

A suggestion: SVOCs used in consumer products

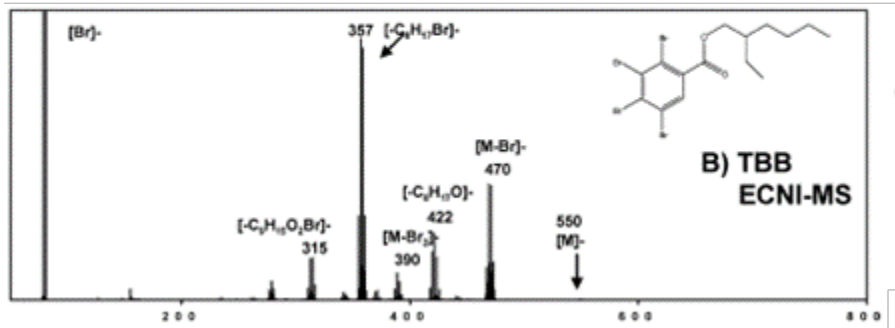
- **Wambaugh et al. ES&T 2012—expocast**
- **Weschler & Nazaroff. Atmosph Environ 2008**

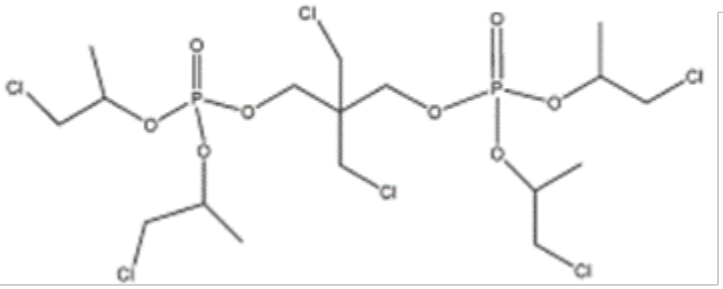
Exposome approaches (with scientific community)

- **Non-targeted analysis**
- **Dust (SWB, products): exposure potential, higher concentrations than serum/urine**

  e.g., identification of TBPH/TBB (FM550), "U-OPFR"

Stapleton et al. *ES&T* 2009,2011





Mutagenic Azo Dyes, Rather Than Flame Retardants, Are the Predominant Brominated Compounds in House Dust

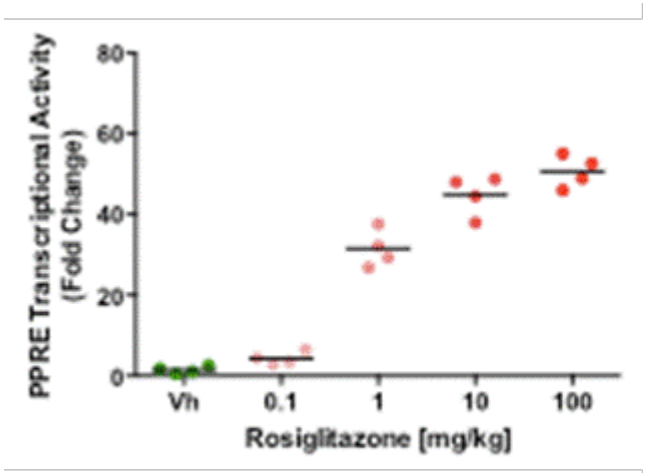
Peng et al. *ES&T* 2016

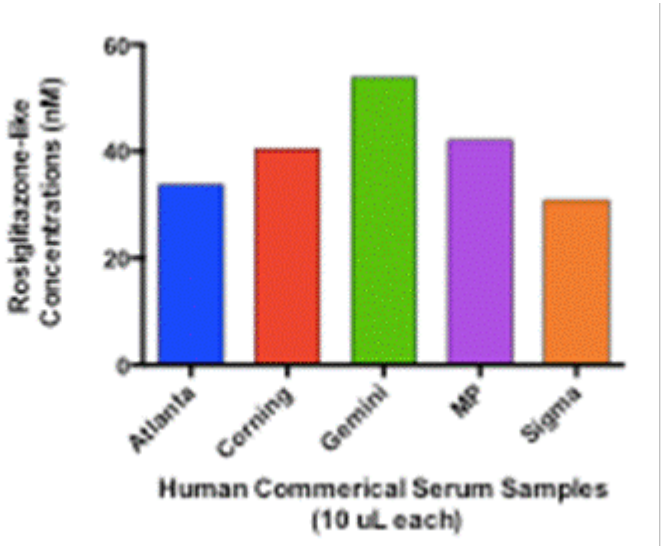
- **Total organic fluorine, bromine**

Are humans exposed to increasing amounts of unidentified organofluorine?

Yeung & Mabury. *Environ Chem* 2016

- **bioassays—measure total biological activity in serum etc.**

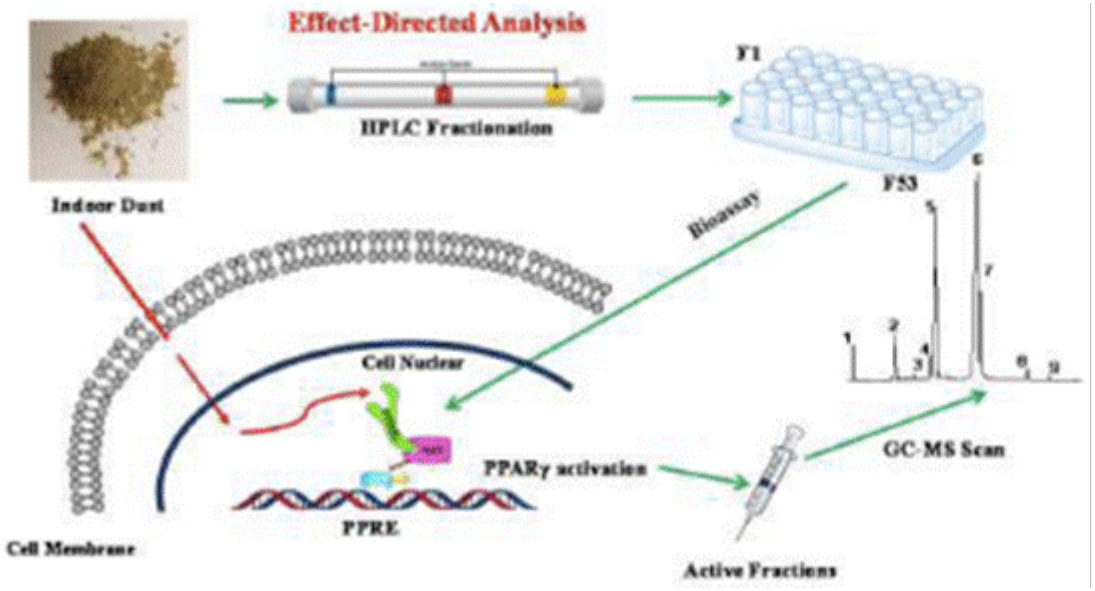




PPARγ reporter assay as exposure biomarker (Edwards et al 2017)

CALUX

- **effect directed analysis: bioassay/fractionation-cycles + analysis**

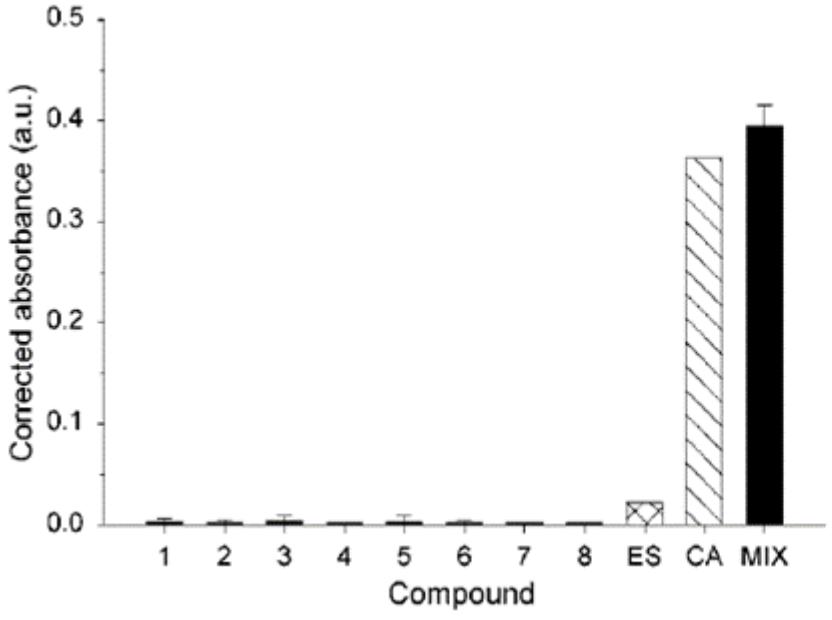


e.g., Fang et al. *ES&T* 2015

PPARγ agonists in dust

Mixtures

- **potential health impact of dose addition**



Something from "Nothing" — Eight Weak Estrogenic Chemicals Combined at Concentrations below NOECs Produce Significant Mixture Effects

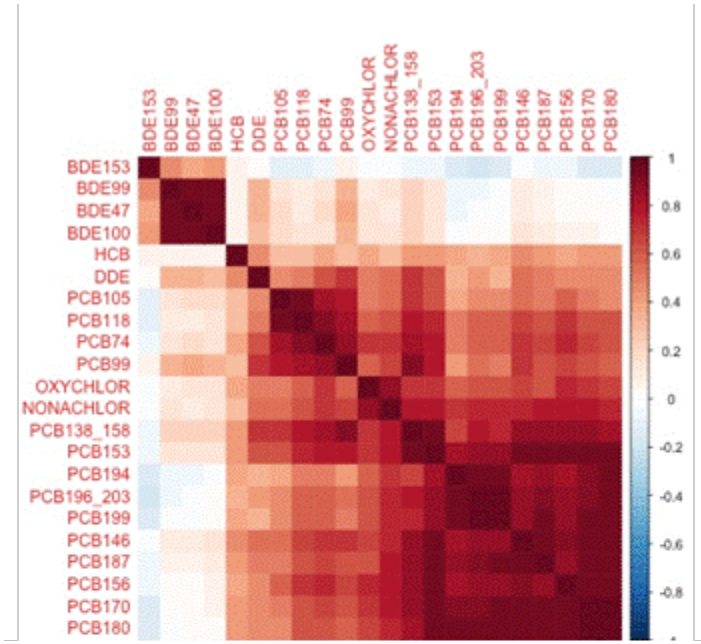
Silva et al. *ES&T* 2002

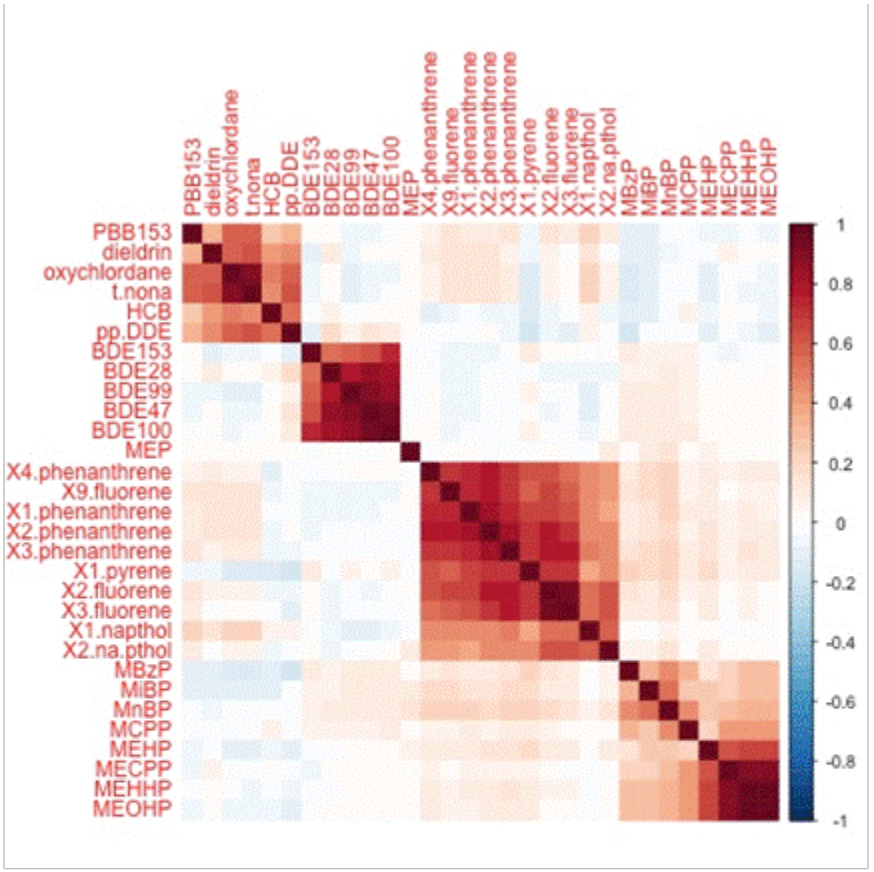
Howard & Webster 2009

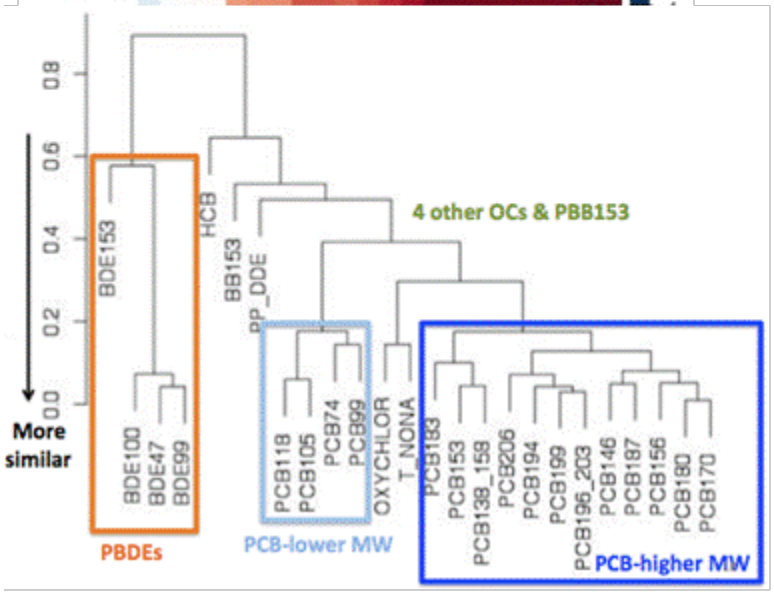
This may be particularly important for endocrine disruptors involving homodimer receptors (e.g., ER, AR), "similar" mechanisms

Mixtures: Patterns of co-exposure

Important for exposure assessment, epidemiology, toxicology







Webster 2016

ISES 2016 symposium

Keep up the great work!