How many lines are connected to your patient? Is there an impact on the child?

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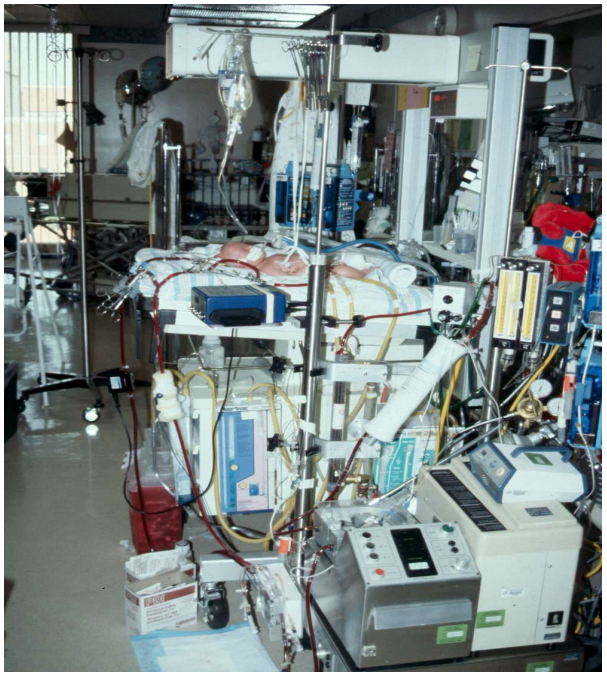
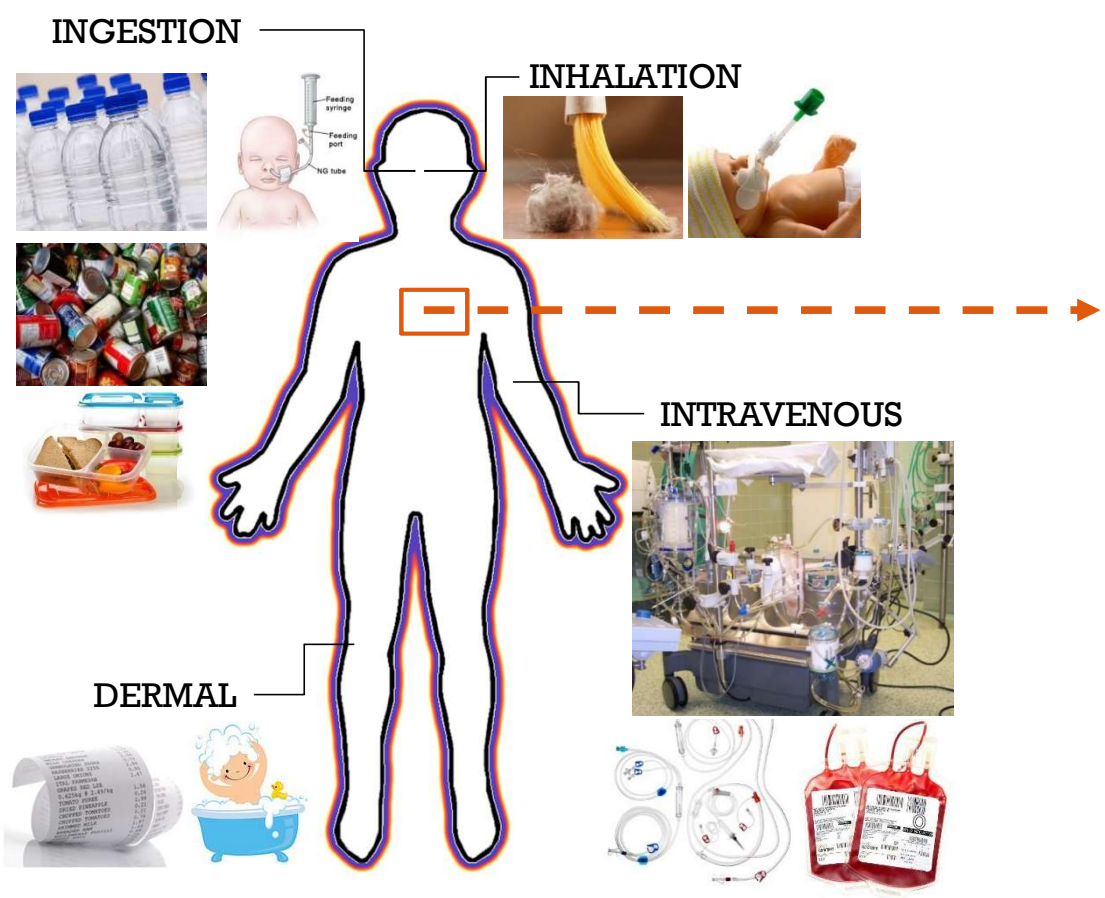
CHEMICALS DETECTED IN 93-98% OF POPULATION

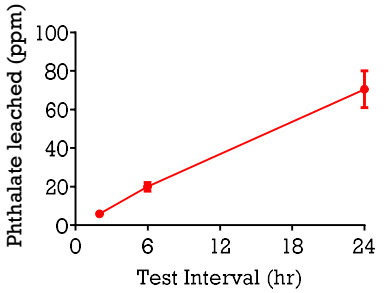
EXPOSURE >4,000 – 160,000X "SAFE" LEVEL

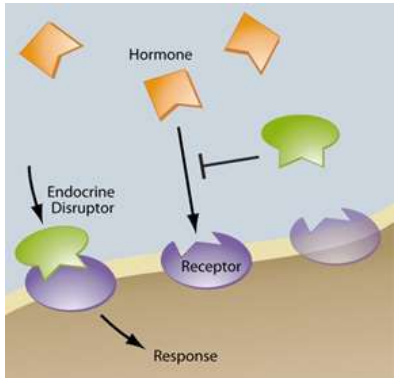


Mallow, et al. 2014. J Perinatology

PHTHALATES & BISPHENOLS - BIOACTIVE CONTAMINANTS







Pediatric issues

- Increased dosage per unit body surface area
- Immature glucuronidation and excretory pathways
- Pancreatic lipases different
- Increased blood-brain / intestinal and testes permeability
- Hand to mouth behavior
- Higher minute ventilation
- Greater consumption of calories per kg/bw
- Developing neurodevelopmental / reproductive system
- Long life

Pediatric exposures

- Blood bags / transfusion sets
- Catheters-UA VV, others
- CPB circuits
- Dialysis / pheresis tubing
- ECMO circuits
- Enteral (ET) nutrition feeding tubes
- Intravenous (IV) bags and tubing
- TPN / enteral bags
- Dialysis membranes

Quantification of DEHP and BPA in the NICU: major exposures from blood and other procedures

Sjoberg	Exchange transfusion: *Transfusion, 1985;25:424*
Plonait	Exchange transfusion: *Transfusion, 1993;33;598*
Karle	ECMO: *Crit Care Med 1997;25:696*
Latini	PVC endotracheal tubes: *Acta Paediatrica, 1999;88:1174*
Loff	Parenteral nutrition lines: *J. Pediatr Surg, 2000;35:1775*
Calafat	Medical procedures: *Pediatrics 2004;113:e429*
Green	Being in NICU: *EHP, 2005;113:1222*
Von Rettberg	Cholestasis: *Pediatrics*, 2009;124:710
Engel Swan	Prenatal exposure and behavior: *EHP*, 2010; doi:10.1289/ehp.0901470 AND *Int J Androl*, 2010;33:259
Vetrano	Anti-inflammatory signaling of neutrophils: *Pediatr Res, 2010;68:134*
Weuve	Intensity of NICU support BPA: *EHP*, 2006;114:1424
Calafat	Medical procedures: *EHP*, 2009;117:163

Endocrine disruptor

Reproductive

Development, miscarriage, sperm count, early puberty, prematurity, intrauterine growth restriction, preeclampsia

Metabolic disorders

Obesity, diabetes

Cancer

Breast, prostate

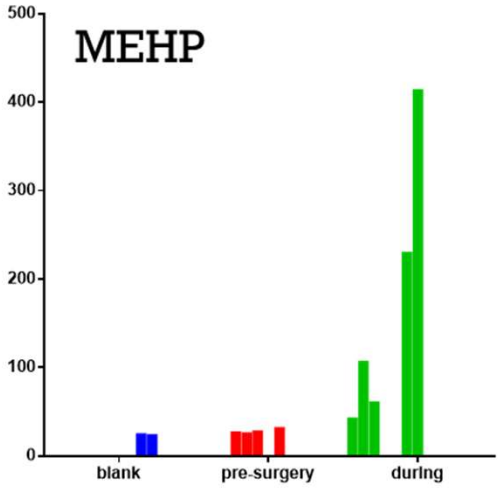
Neurological

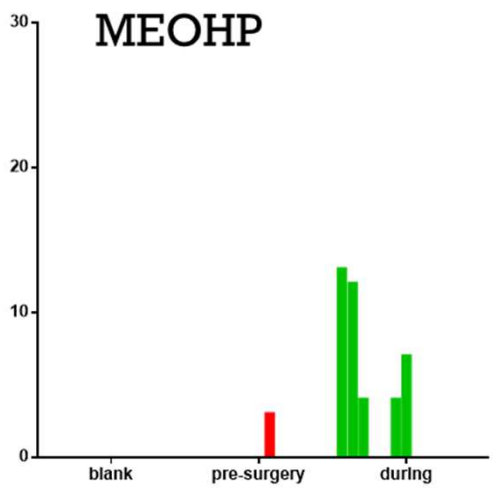
Development, behavior (depression, autism)

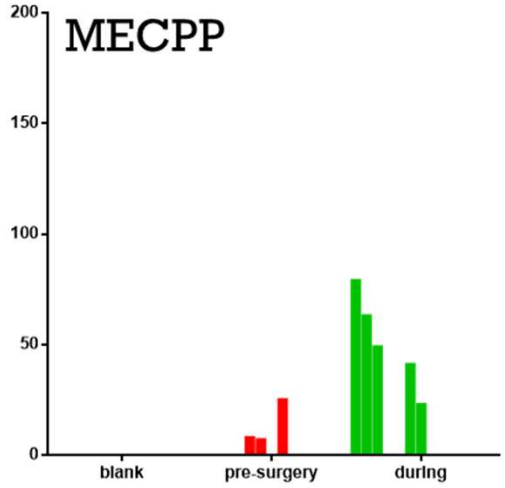
Cardiovascular

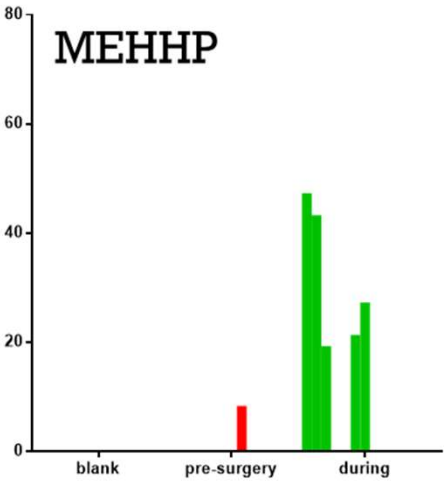
Hypertension, angina, myocardial infarction, atherosclerosis, heart rate variability

33% increased risk of MI

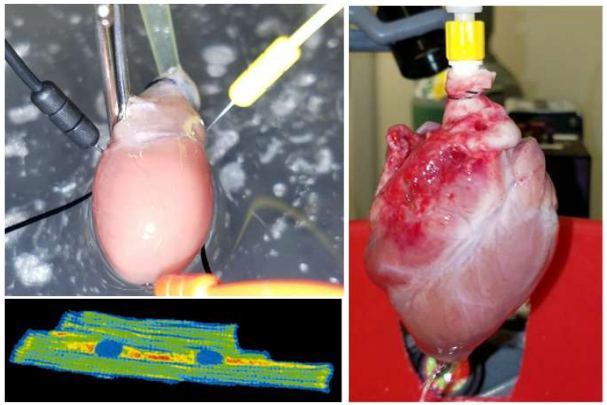

MEHP
500
400
300
200
100
0
blank
pre-surgery
durlng

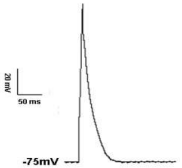

MEOHP
30
20
10
0
blank
pre-surgery
durlng

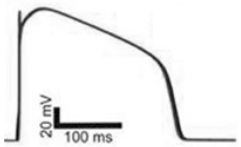

MECPP
200
150
100
50
0
blank
pre-surgery
durlng

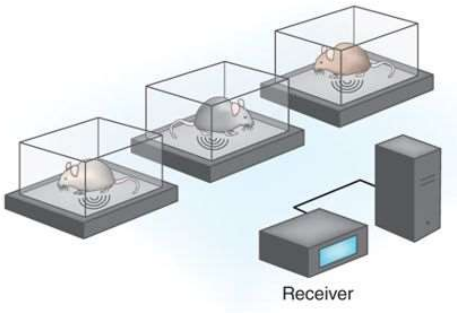

MEHHP
80
60
40
20
0
blank
pre-surgery
during

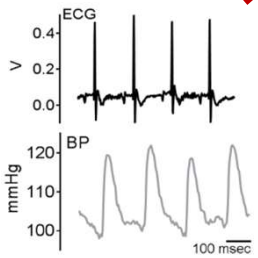
ANIMAL MODELS



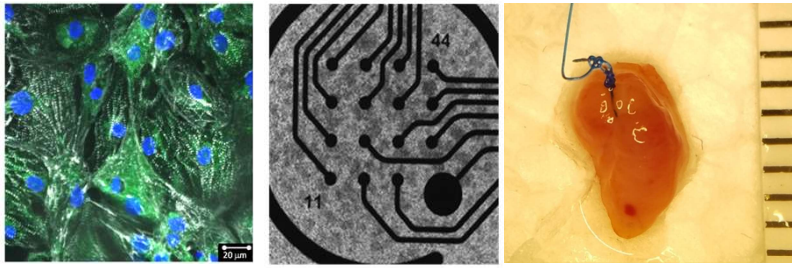


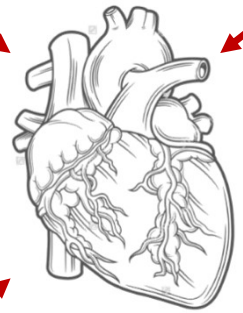


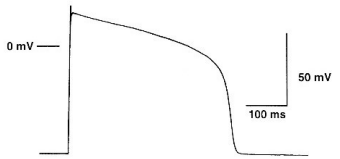


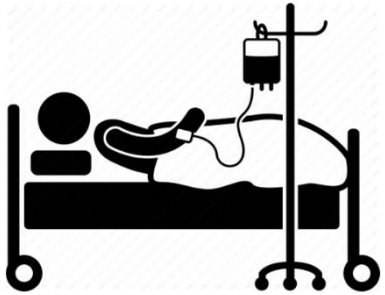


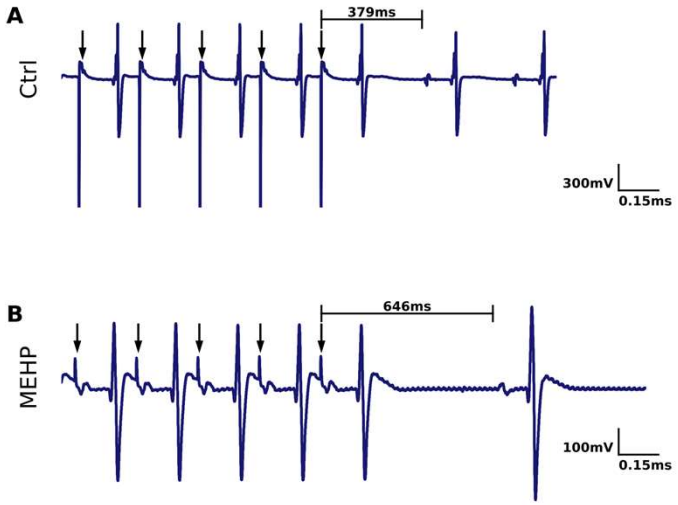
HUMAN MODELS

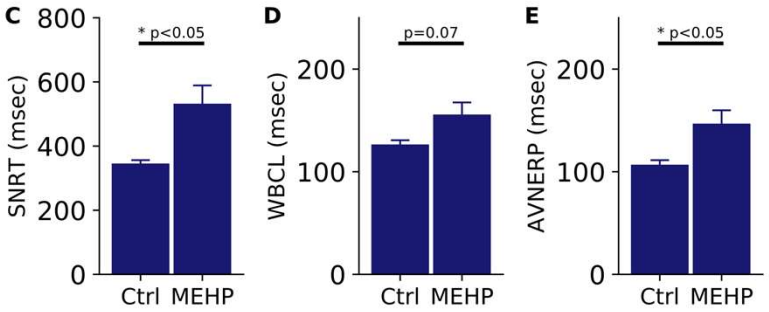


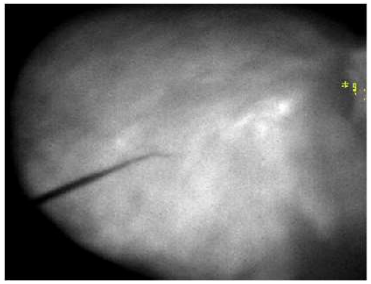


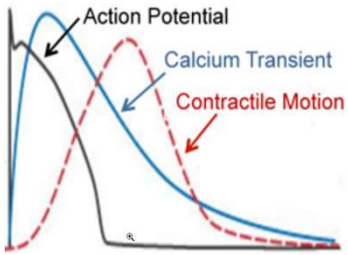


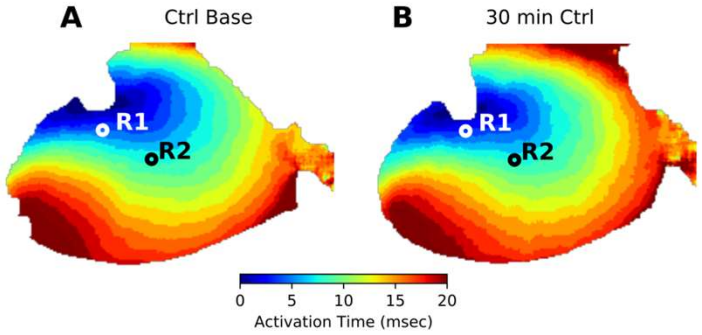


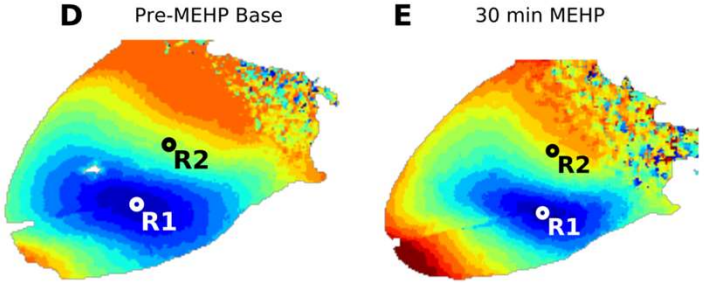

A
Ctrl
379ms
300mV
0.15ms
B
MEHP
646ms
100mV
0.15ms

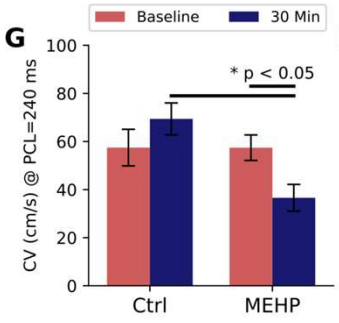

C
SNRT (msec)
* p<0.05
Ctrl MEHP
D
WBCL (msec)
p=0.07
Ctrl MEHP
E
AVNERP (msec)
* p<0.05
Ctrl MEHP

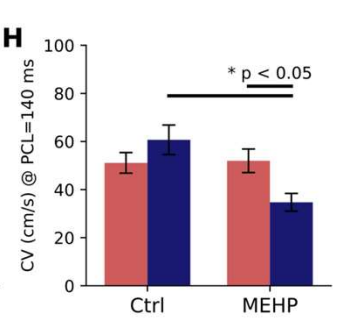


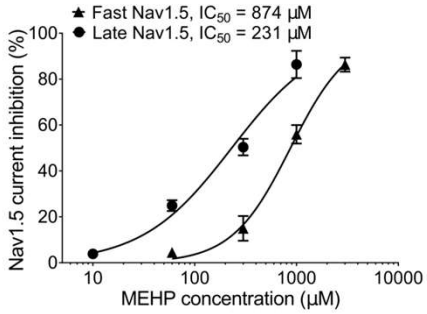

Action Potential
Calcium Transient
Contractile Motion

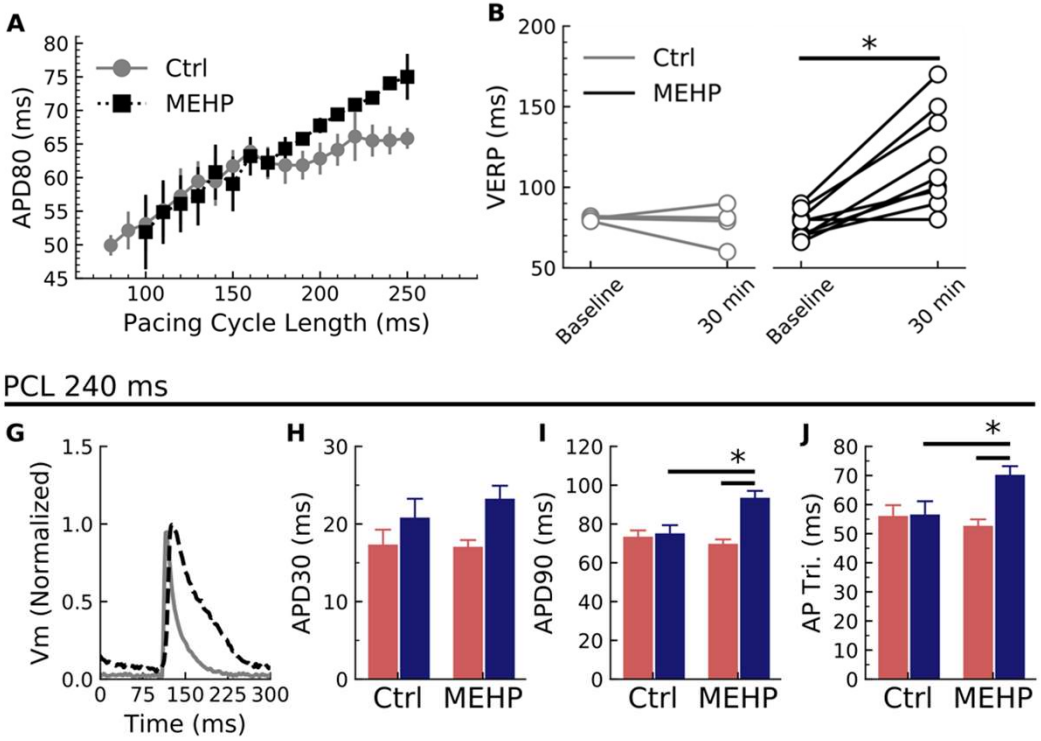

A
Ctrl Base
B
30 min Ctrl
R1
R2
0 5 10 15 20
Activation Time (msec)

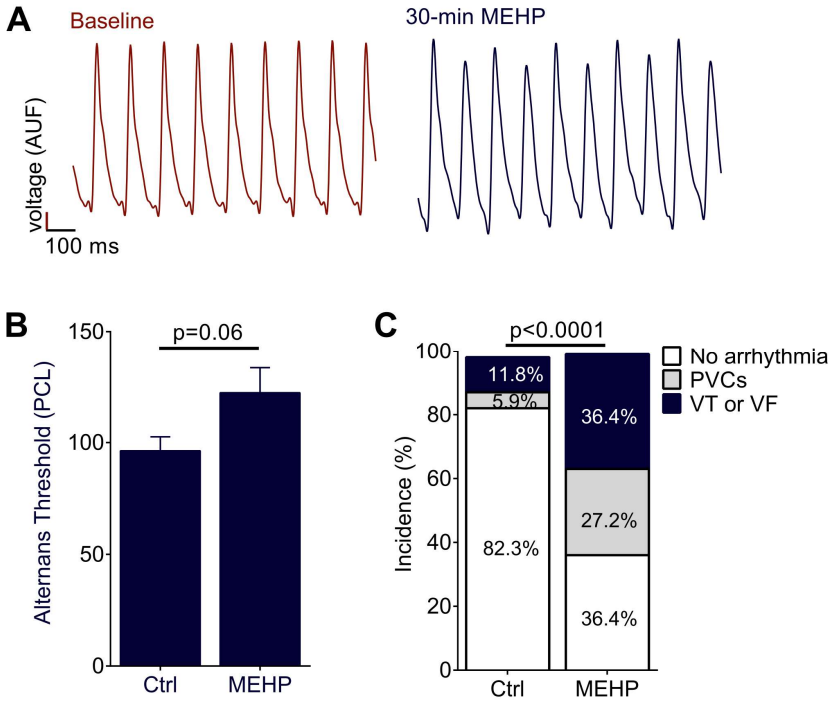

D
Pre-MEHP Base
E
30 min MEHP
R2
R1


G
Baseline
30 Min
CV (cm/s) @ PCL=240 ms
* p < 0.05
Ctrl MEHP


H
CV (cm/s) @ PCL=140 ms
* p < 0.05
Ctrl MEHP

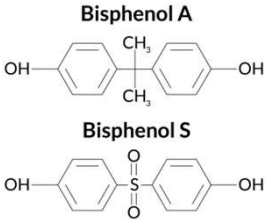

I
Fast Nav1.5, IC50 = 874 µM
Late Nav1.5, IC50 = 231 µM
Nav1.5 current inhibition (%)
MEHP concentration (µM)


A
APD80 (ms)
Ctrl
MEHP
Pacing Cycle Length (ms)
B
VERP (ms)
Ctrl
MEHP
*
Baseline
30 min
Baseline
30 min
PCL 240 ms
G
Vm (Normalized)
Time (ms)
H
APD30 (ms)
Ctrl
MEHP
I
APD90 (ms)
*
Ctrl
MEHP
J
AP Tri. (ms)
*
Ctrl
MEHP


A
Baseline
30-min MEHP
voltage (AUF)
100 ms
B
Alternans Threshold (PCL)
p=0.06
Ctrl
MEHP
C
p<0.0001
Incidence (%)
11.8%
5.9%
82.3%
36.4%
27.2%
36.4%
No arrhythmia
PVCs
VT or VF
Ctrl
MEHP

Dilemma: Does the clinical benefit outweigh the risks?

- **Extrapolation from animal studies to humans**
- **Availability/safety of alternatives**
- **Economic implications**
- **Who's paying for the scientific research upon which decisions being made**



BPA Substitute May Pose Toxic to Heart Health

Posted on July 22, 2014, 6 a.m. in Women's Health | Cardio-Vascular | Environment

Now generally considered as an endocrine disrupting chemical, bisphenol A (BPA) has been widely used in the production of plastic consumer goods. Its chemical cousin, bisphenol S (BPS), is increasingly becoming an alternative to BPA, yet health risks of BPS remain largely unknown. Hong-Sheng Wang, from the University of Cincinnati (Ohio, USA), and colleagues perfused, BPS through the arteries of the hearts of live lab rats, which were chemically stimulated to mimic stress. Exposure to BPS rapidly increased the heart rate of female rats and under the stress condition led to arrhythmias—heart rhythm abnormalities—far greater than in the control rats that did not receive BPS. Among the