Make vampire food safe for vampires, again.
Hormone-related cancers

ADHD

Learning disabilities

Pre-term birth

Endometriosis

Infertility

Heart disease

Degenerative diseases

Fibroids

Obesity

Asthma

Allergies

Autism

Obesity

polycystic ovaries

Environmental Health Sciences
Hormones guide gene expression
EDCs hack the system

Environmental Health Sciences
Hormones guide gene expression

EDCs hack the system
Hormones guide gene expression
EDCs hack the system
Two ways to think about genes

Heredity: What we get from our parents

Gene behavior: Chemical manufacturing machines... nature's nanotechnology
What changes gene expression?

“Classic Genetics”

- Heredity
- Other genes and signals they send

“Classic Environment”

- Diet
- Stress
- Experience
- Environmental contaminants

Environmental Health Sciences
Low level exposures affect gene expression

Bisphenols
PFAS compounds
Phthalates
Different generations of flame retardants
Dioxins, PCBs, DDT
Uranium, arsenic, cadmium
Soy phytoestrogens
etc.
Diet       experience        stress        contamination

Genetics  vs.  Heredity

Environment

Health
Conceptual shift

Old... a disease that is linked to genes is a disease under hereditary control.

New... a disease linked to genes is one vulnerable to environmental causes.
Science is explored by people
Health Effects from Endocrine Disrupting Chemicals Cost the EU 157 Billion Euros Each Year. This is the tip of the iceberg: Costs may be as high as €270B.

**€157B Cost by Health Effect**

- Male Reproductive Disorders: 4
- Premature Death: 6
- Obesity & Diabetes: 15
- Neurological Impacts (Including ADHD): 132

**€157B Cost by EDC Type**

- Pesticides: 120
- Plastic: Phthalates & BPA: 2
- Flame Retardants: Other

Note: The economic estimates do not include all costs associated with these conditions.

Endocrine Disrupting Chemicals (EDCs) interfere with hormone action to cause adverse health effects in people. The data shown to the left are based on fewer than 5% of all EDCs. Many EDC health conditions were not included in this study because key data are lacking. Other health outcomes will be the focus of future research.

Revolution in science

1. Low doses matter a lot
2. Events in the womb don’t stay in the womb
3. Testing methods are deeply flawed
4. Exposure is ubiquitous
2.5 parts per billion of atrazine
ATRAZINE

Recommended application

1,000,000

10,000

100

1

0.1 PPB

- Run-off
- Streams
- Safe short term
- Surface water
- Safe for drinking water
- Rain

This result

Hayes et al. 2002
Revolution in science

1. Low doses matter a lot

2. Events in the womb don’t stay in the womb

3. Testing methods are deeply flawed

4. Exposure is ubiquitous
Transgenerational epigenetic inheritance

Family 1

Family 2

Family 3
Long-term trends in human sperm

(b) Figure showing a 59.3% decline in sperm quality over time.

- Unselected Western
- Unselected Other
- Fertile Western
- Fertile Other

Year of sample collection:
- 1970
- 1980
- 1990
- 2000
- 2010
Revolution in science

1. Low doses matter a lot
2. Events in the womb don’t stay in the womb
3. **Testing methods are deeply flawed**
4. Exposure is ubiquitous
Testing methods are deeply flawed

1. Tools agencies use for establishing safety are outdated, mostly irrelevant and based on false assumptions

2. Laws and regulations outdated

3. They stay that way because of the financial stakes and the effectiveness of manufactured doubt
1 part per billion

Same strain of mice
Same caloric intake
Same activity levels

1 part per billion  What about 1000 ppb?

Same strain of mice
Same caloric intake
Same activity levels

Non-monotonicity of tamoxifen

Welshons, in Vandenberg et al. 2012
Non-monotonicity: Laura Vandenberg

Hormones and Endocrine-Disrupting Chemicals: Low-Dose Effects and Nonmonotonic Dose Responses

Laura N. Vandenberg, Theo Colborn, Tyrone B. Hayes, Jerrold J. Heindel, David R. Jacobs, Jr., Duk-Hee Lee, Toshi Shioda, Ana M. Soto, Frederick S. vom Saal, Wade V. Welshons, R. Thomas Zoeller, and John Peterson Myers

What’s wrong with that picture?

1. Tools agencies use for establishing safety are outdated, mostly irrelevant and based on false assumptions

2. Laws and regulations outdated
What’s wrong with that picture?

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Revolution in science

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Nick Kristof last autumn (NYT):

“These days we spew fewer toxins into our air and rivers, and instead we dump poisons directly into our own bodies.”
We assume that products in the market have been tested for safety.

But the vast majority of chemicals have barely been tested at all.
Presence of the Corexit component dioctyl sodium sulfosuccinate (DOSS) in Deepwater Horizon oil spill.

Gray JL, Kanagy LK, Furlong ET, Kanagy CJ, McCoy JW, Mason A, Lauenstein G.

Effects of Crude Oil/Dispersant Mixture Components on PPARγ Activity in Vitro of Dioctyl Sodium Sulfosuccinate (DOSS) Probable Obesogen

Alexis M. Temkin,1* Robert R. Bowers,2* Margaret E. Magaletta,3 Steven Holshouser,4 Adriana Maggi,5 Paolo Ciana,5 Louis J. Guillette,1,6 John A. Bowden,7,8 John R. Kucklick,7,8 John E. Baatz,7,8,9 and Demetri D. Spyropoulos1,2,7,8
Where’s the good news?

1. The science grows ever stronger

2. The medical community is getting on board

3. Consumers are demanding safer materials

4. We have the science to help chemists make those safer materials

5. The states are improving policies; so is Europe
Environmental Health Sciences
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