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A Career in Risk Assessment: Working as a Regulatory Scientist

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Society of Toxicology Postdoctoral Assembly
A Career in Risk Assessment
What is it? And How Do You Get Started?

The views expressed in this presentation are those of the author and do not necessarily reflect the views or policies of the U.S. EPA

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Conflict of Interest Disclosures

I have no actual or potential conflict of interest to disclose in relation to this presentation.

EPA Office of Research and Development

United States Environmental Protection Agency

- The Office of Research and Development (ORD) is the scientific research arm of EPA
  - 558 peer-reviewed journal articles in 2016
- Research is conducted by ORD's three national laboratories, four national centers, and two offices
  - Includes **National Center for Computational Toxicology**
- 14 facilities across the country
- Six research programs
  - Includes **Chemical Safety for Sustainability**
- Research conducted by a combination of Federal scientists; contract researchers; and postdoctoral, graduate student, and post-baccalaureate trainees

ORD Facility in
Research Triangle Park, NC

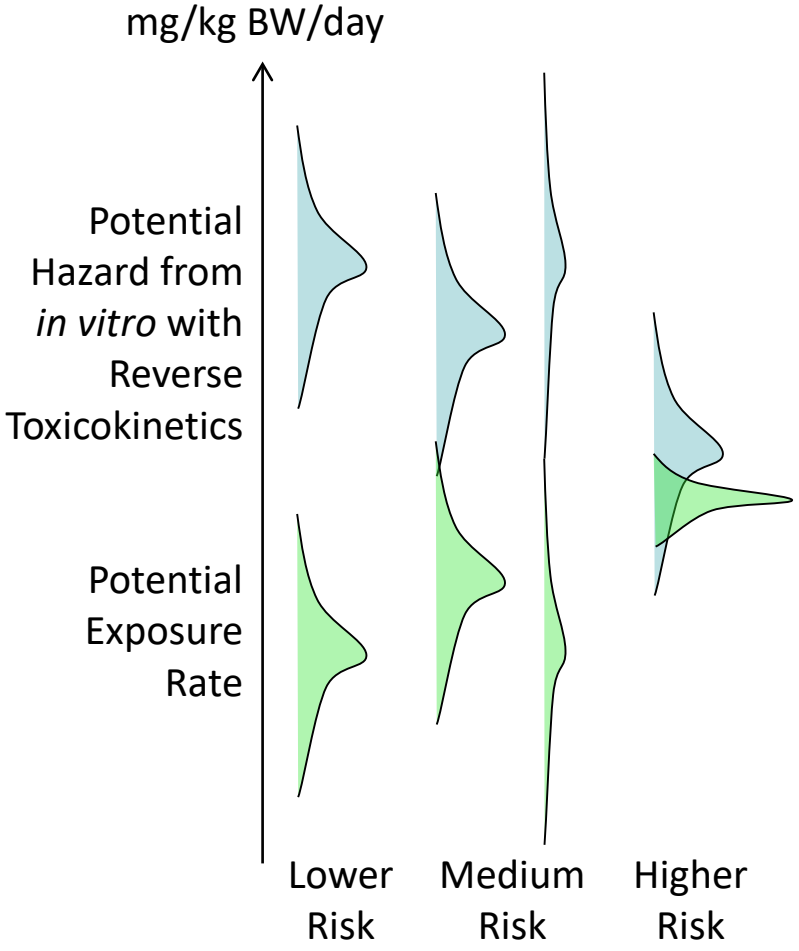
Chemical Regulation in the United States

- A tapestry of laws covers the chemicals people are exposed to in the United States (Breyer, 2009)
- Different testing requirements exist for food additives, pharmaceuticals, and pesticide active ingredients (NRC, 2007)
- Most other chemicals, ranging from industrial waste to dyes to packing materials, are covered by the Toxic Substances Control Act (TSCA)
  - Thousands of new chemical use submissions are made to the EPA every year
  - TSCA was updated in June, 2016 to allow evaluation of these and other chemicals

November 29, 2014

Chemical Risk = Hazard + Exposure

- National Research Council (1983) identified chemical risk as a function of both inherent hazard and exposure
- To address thousands of chemicals, we need to use “high throughput methods” to prioritize chemicals for additional study
- **High throughput risk prioritization** needs:
  1. high throughput **hazard** characterization (from HTT project)
  2. high throughput **exposure** forecasts
  3. high throughput **toxicokinetics** (*i.e.*, dosimetry) linking hazard and exposure
- All of these methods are uncertain, but if that uncertainty can be quantified, we can make informed decisions



My Background

There are generalist and specialists. We absolutely need both. I work as a generalist.

1997: My first conference paper was on a software interface for neural network analysis of **architectural** energy efficiency

1999: B.S. in physics and part of my thesis was my first journal paper on computer simulation of **high temperature superconductors**

2001: M.S. in physics, changed schools from Georgia Tech to Duke, spent summer in Los Alamos working on computer simulation of "stochastic ratchets"

2005: M.S. in computer science, published thesis on graph theoretic analysis of **granular matter**

2006: Ph.D. in physics, dissertation on experimental studies of granular matter

2006: started post-doc with Woody Setzer and Hugh Barton of EPA on **statistical analysis** of **toxicokinetic models**

2008: I was hired full time by EPA to help build virtual tissue simulations (**Virtual Liver**) – and I was quickly roped into the Toxicity Forecaster (**ToxCast**) project

2009: I started working with Rusty Thomas and Barbara Wetmore on **high throughput toxicokinetics**

2011: I started working on high throughput exposure models and data (the **ExpoCas**t project) to provide a context for ToxCast data

2014: EPA/NCCT awarded the ExpoCast data contracts, which opened up access to non-targeted analytical chemistry techniques

2018: I am still working on ExpoCast, ToxCast, and high throughput toxicokinetics

Regulatory Science

United States Environmental Protection Agency

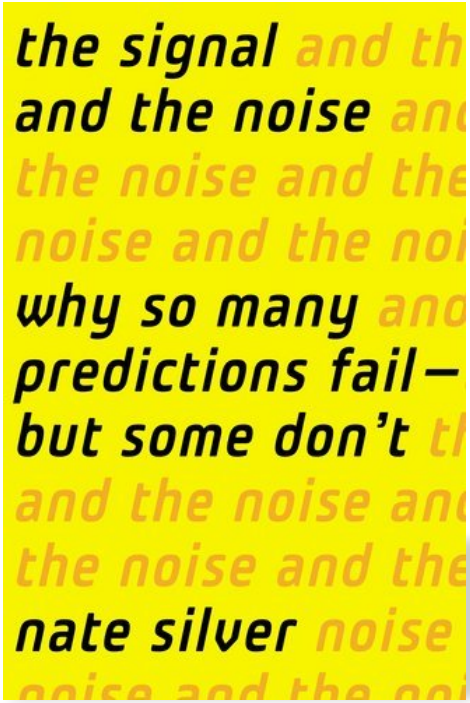
- All projects begin with **1)** an objective, **2)** resources, **3)** a time-line
- All three project elements can be intertwined:
  - Someone needs the best available information given the time and resources
- Regulatory science balances timeliness with a new for “best available” methodology
- What is the best answer I can provide today, in a week, in a year?
  - How can I be explicit about what I did and did not consider?
  - Expect to revisit your work a decade later.
- I recommend leading with your finding (as in an executive summary)
  - Regulators need to make a decision
  - Scientists are trained to note exceptions, qualifiers, and possible confounders
    - Always include them, but don’t lead with them

How to Make Good Forecasts

1) **Think probabilistically**: ExpoCast evaluates model performance systematically across as many chemicals (and chemistries) as possible

2) **Forecasts change** : Today's forecast reflects the best available data today but we must accept that new data and new models will cause predictions to be revised
   - Corollary: Any approach that can't accommodate new data should be avoided

3) **Look for consensus**: We evaluate as many models and predictors/predictions as possible



Nate Silver (2012)

Conclusions

- Be open to where life takes you – everything is experience if you learn something from it

- Regulatory science balances timeliness with a need for best available methods
  - What is the best answer I can provide today, in a week, in a year?
  - How can I be explicit about what I did and did not consider?
  - Expect to revisit your work a decade later.
  - Take project management and leadership classes

- Success is a combination of skill and luck, and networking increases your luck:
  - Get an Open Researcher and Contributor ID (**ORCID**), https://orcid.org/
  - Join sites like **LinkedIn**, https://www.linkedin.com/
  - Join sites like **ResearchGate**, https://www.researchgate.net/
  - Network at conferences: Attend SoT Specialty Section Meetings

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