



www.acs.org/acswebinars



## Navigating Questions About Reproductive Health When in the Lab



KATIE MCGEOUGH, PhD

Graduate Student, Boston College  
School of Social Work



ROBIN IZZO, MS

Assistant Vice President  
Environmental Health and Safety  
Princeton University



RICH WITTMAN, MD, MPH

Medical Director, Stanford University  
Occupational Health Center



RALPH STUART, CIH, CCHO

Membership Chair, Division of  
Chemical Health and Safety,  
American Chemical Society

This ACS Webinar® is co-produced with the ACS Division of Chemical Health and Safety and ACS Committee on Chemical Safety.

17

17

## Paragraph Description



A recent analysis of the current guidance from more than 100 academic institutions' Chemical Hygiene Plans (CHPs) indicates that **the burden to implement laboratory reproductive health and safety practices is often placed on those already pregnant or planning conception**. This report also found **inconsistencies in the classification of potential reproductive toxins by resources generally considered to be authoritative**, adding further confusion. This panel will discuss these findings reported in the *Journal of American Chemical Society* and provide **environmental health and safety and medical perspectives** on the questions that it raises.



Ralph

18

18

## Learning Objectives



- After this webinar, you will understand the current state of knowledge relative to the potential reproductive health impacts of laboratory work, including chemical, biological and physical concerns
- Identify questions that people considering pregnancy or currently pregnant should ask about their work in the laboratory
- How to find and evaluate literature resources related to reproductive health issues in the lab



Ralph

19

19



### Audience Survey Question

ANSWER THE QUESTION ON THE INTERACTIVE SCREEN IN ONE MOMENT

**What are the barriers that you perceive to reporting a pregnancy by the lab workers?**

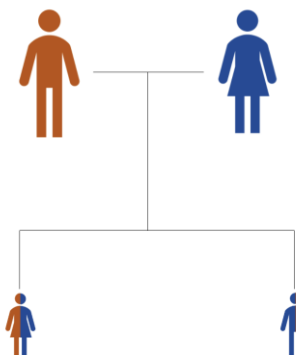
- A) Concerns about impacts on professional development
- B) Concerns about being allowed to work in a laboratory
- C) Lack of scientific information about reproductive health risks with exotic material
- D) Social concerns related to pregnancy

\* If your answer differs greatly from the choices above **tell us in the questions window!**

20

20

## Increased Attention to Lab Safety



- Over the past decade there have been significant efforts at improving laboratory safety
- Still a lack of clear guidance pertaining to reproductive health within laboratories
  - Reference material does not contain information pertaining to reproductive health or information is conflicting between sources
  - Often framed as a female issue, when half of our genetics come from males



Katie

Kemsley, J. 10 years after Sheri Sangji's death, are academic labs any safer? <https://cen.acs.org/safety/lab-safety/10-years-Sheri-Sangji-death/2021> (accessed Apr 7, 2021).  
Pain, E. Pregnancy and the Lab--Feature Index <https://www.sciencemag.org/careers/2006/04/pregnancy-and-lab-feature-index> (accessed Apr 7, 2021).

21

21

## Current Information



- Reference material does not contain information pertaining to reproductive health or information is conflicting between sources
- Exposure of men or women to reproductive toxins can lead to:
  - Infertility
  - Reduced fertility
  - Genetic damage to germ cells
  - Pre-term birth
  - Low birth weight
  - Fetal central nervous system malformation
- Often framed as a female issue
  - Puts the onus on women to create safe working environments
  - Because reproductive health is a male and female issue, protecting just women is not sufficient



Katie

Pain, E. Pregnancy and the Lab--Feature Index <https://www.sciencemag.org/careers/2006/04/pregnancy-and-lab-feature-index> (accessed Apr 7, 2021).  
U.S. News and World Report. Best Chemistry Programs. <https://www.usnews.com/best-graduate-schools/top-science-schools/chemistry-rankings> (accessed Mar 23, 2021).

22

22

## Safety Models

**Unified protection** – universal model – safety model in which all workers follow the recommended guidelines for protection of the group which is most sensitive to chemical exposure

**Differentiated protection** – individualistic model – aims to protect the sensitive group by reducing only the exposure of that group

### Reasons why differentiated protection is not enough:

- unplanned conception
- when pregnancy is not immediately known
- bioaccumulation effects



Hansson, S. O.; Schenk, L. *Eur. J. Risk Regul.* **2016**, 7, 404–412.  
Hansson, S. O. *J. Radiol. Prot.* **2009**, 29, 211–218.

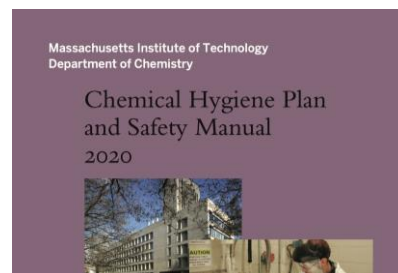
23

23

## Available Information

**Chemical Hygiene Plans (CHPs)** – a common first resource that a laboratory worker references to begin research on reproductive toxin exposure

- **Purpose:** safety manuals that inform laboratory workers of chemical dangers as well as proper workplace safety practices
- Required document by OSHA's Laboratory Standard
- No requirement for who writes this document
- Data comes from various sources (often uncited)
- No required section on reproductive health – allowing institutions to formulate their own guidance



United States Department of Labor. Hazardous Chemicals in Labs. [https://www.osha.gov/OshDoc/data\\_General\\_Facts/hazardouschemicalsinlabs.pdf](https://www.osha.gov/OshDoc/data_General_Facts/hazardouschemicalsinlabs.pdf) (accessed Mar 26, 2021).

24

24

## Assessment of University CHPs



- **CHPs from the top 100 ranked US graduate chemistry programs were assessed** (105 were assessed due to ties in rankings)

### Accessibility

Assessed by a Google search for “[school name] chemical hygiene plan” to see whether the CHP appeared in the first page of results

### Accessibility Results

- **87** appeared within the first page of results
- **6** were found after further searching
- **12** were not found at all



With Dr. Sarah Jane Mear

25

25

## Assessment of University CHPs



- **CHPs from the top 100 ranked US graduate chemistry programs were assessed** (105 were assessed due to ties in rankings)

### Accessibility Results

- **87** appeared within the first page of results
- **6** were found after further searching
- **12** were not found at all

### Reproductive Health within CHPs

- **31** had a section on reproductive health safety within the Table of Contents
- **54** mentioned “pregnan[cy][t]” or “male [reproductive health]” (or both) anywhere in the document



With Dr. Sarah Jane Mear

26

26

## Assessment of University CHPs

- **CHPs from the top 100 ranked US graduate chemistry programs were assessed** (105 were assessed due to ties in rankings)



### Accessibility Results

- **87** appeared within the first page of results
- **6** were found after further searching
- **12** were not found at all

### Reproductive Health within CHPs

- **31** had a section on reproductive health safety within the Table of Contents
- **54** mentioned "pregnan[cy][t]" or "male [reproductive health]" (or both) anywhere in the document

### Language within CHPs

- **17** only mentioned pregnancy
- **9** only mentioned male reproductive health
- **28** mentioned both female and male reproductive health



With Dr. Sarah Jane Mear

27

27

## Reproductive Health Language within CHPs

### The language used implies

- reproductive health only affects certain groups
- sensitive group should take on the responsibility creating a safe work environment

**General summary:** CHPs suggest the use of a differentiated protection model – which, as stated before, is not sufficient for protection of everyone



With Dr. Sarah Jane Mear

28

28

## Additional Resources from CHPs

Reproductive health is a personal topic, so we wanted to further evaluate the discreet resources to see how well they advised researchers

### Non-discreet resources:

- Environmental Health and Safety office
- Principal Investigator
- Primary Care Physician

### Discreet resources:

- Safety Data Sheets (SDSs)
- NIOSH Pocket Guide (NPG)
- Proposition 65 (Prop. 65)
- Lists of reproductive toxins within the CHPs



### California Proposition 65 Warning

**WARNING:** This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.  
For more information visit: [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov)



Katie

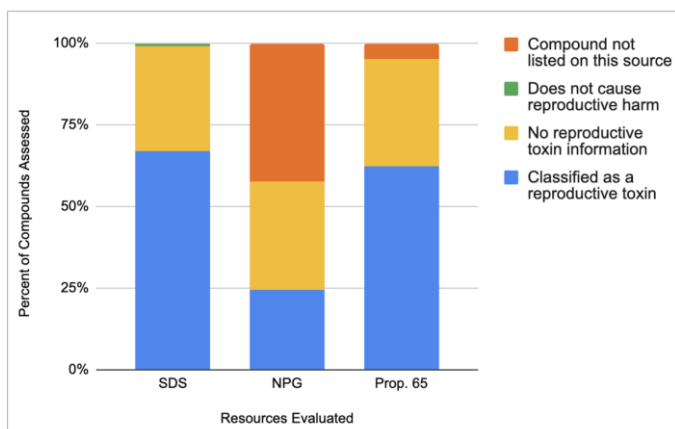
With Dr. Sarah Jane Mear

29

29

## Comparison of Discreet Resources

- How the top 107 reproductive toxins from CHPs are classified via SDS, NPG, and Prop. 65



Katie

With Dr. Sarah Jane Mear

30

30

## Common “Reproductive Toxins”

- 14 most reported reproductive toxins from CHPs as well as their SDS, NPG, and Prop. 65 classification

CAS	Chemical Name	Occurrence in CHPs	Reproductive Information Found in		
			SDS	NPG	Prop. 65
7439-92-1	lead	23			
75-15-0	carbon disulfide	23			
108-88-3	toluene	22			
71-43-2	benzene	20			
75-21-8	ethylene oxide	20			
75-01-4	vinyl chloride	18			
96-12-8	1,2-dibromo-3-chloropropane	18			
7440-43-9	cadmium	16			
75-12-7	formamide	16			
109-86-4	ethylene glycol monomethyl ether	15			
1330-20-7	xylene	14			
50-00-0	formaldehyde	13			
50-18-0	cyclophosphamide	13			
67-66-3	chloroform	13			

- Compound not listed on this source
- Does not cause reproductive harm
- No reproductive toxin information
- Classified as a reproductive toxin



Katie

With Dr. Sarah Jane Mear

31

31

## Merits of Each Resource

### Chemical Hygiene Plans (CHPs)

**Pros:** available in all labs with hazardous chemicals

**Cons:** lack of expert oversight regarding contents

### Safety Data Sheets (SDSs)

**Pros:** available for all commercially available chemicals

**Cons:** lack of expert oversight regarding contents

### NIOSH Pocket Guide (NPG)

**Pros:** contents provided by scientists/experts in the field, includes only chemicals that have PELs and RELs

**Cons:** not an inclusive list because only includes chemicals with PELs and RELs

### Proposition 65

**Pros:** contents provided by scientists/experts in the field, includes all chemicals that could potentially be reproductive toxins

**Cons:** does not contain exposure limits



Katie

With Dr. Sarah Jane Mear

32

32



## Conclusions and Recommendations



### Opportunities for improvement of university CHPs:

- All CHPs contain a section on reproductive health (using inclusive language)
- Include recommended resources with explanations of how to best utilize each source

### General laboratory recommendations:

- Help normalize conversations pertaining to reproductive health by having laboratory level discussions – help shift away from a differentiated safety model towards unified protection



With Dr. Sarah Jane Mear

33

33



## Audience Survey Question

ANSWER THE QUESTION ON THE INTERACTIVE SCREEN IN ONE MOMENT

### Is the issue of reproductive health an important consideration for your laboratory group?

- A) We have not faced this issue before
- B) We have had concerns about this issue raised, but weren't sure how to address them
- C) We have people who researched this issue on their own and changed their laboratory practices as a result
- D) Our lab team discusses the issue as group, and we have a proactive plan for how to respond if someone in the laboratory becomes involved in a pregnancy

\* If your answer differs greatly from the choices above **tell us in the questions window!**

34

34

# Environmental Health and Safety Perspective

**Robin Izzo, MS**

Assistant Vice President

Environmental Health and Safety

Princeton University

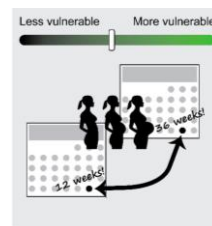
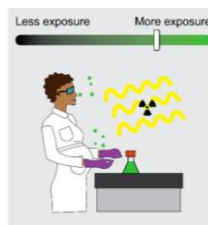
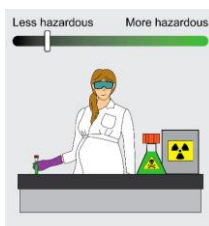


35

$$\text{RISK} = f(\text{Hazard, Exposure, Vulnerability})$$



- **Control the hazard**
  - Replace with less hazardous
- **Control the exposure**
  - Reduced time
  - Reduced quantity
  - Engineering controls
  - Personal protective equipment
    - Respiratory protection
- **Stage of pregnancy may matter**



Robin

Graphic source: <https://pubs.acs.org/doi/10.1021/acs.chemrestox.1c00380>

36

36

## Princeton EHS Process



Primer on  
Reproductive Toxins



OPEN

or

CONFIDENTIAL



<https://ehs.princeton.edu/>

37

37

## Benefits of Sharing News

- Enables conversation
- Removes speculation
- Lab mates may take less risk and be more careful around the individual
- Able to discuss options for reducing risk, as appropriate



<https://ehs.princeton.edu/>

38

38

## Princeton EHS Process



- Visit is optional and can be confidential
- Conditions, materials, operations
- Safety record for the lab
- List of most commonly used chemicals



<https://ehs.princeton.edu/>

39

39

## Princeton EHS Process



- Summary of known or suspected reproductive hazards
- Recommendations
- Information to share with OB/GYN, fertility, or healthcare providers

### ANTHRACENE

- Crystalline material, white when pure, yellow/green/blue when impure. Not volatile.
- Skin contact may cause mild irritation. May cause photosensitivity upon skin contact.
- Toxicological information for anthracene specifically is limited. Due to its similarity of structure with benzo(a)pyrene, there is some concern that toxic effects may be similar.
- Anthracene is not listed as a carcinogen by NTP, IARC, OSHA or ACGIH. However, benzo(a)pyrene is a suspected human carcinogen.

### Issues for Pregnant Women

- Specific information is not available. Benzo(a)pyrene (BaP) is suspected to be embryotoxic and teratogenic.
- BaP has been shown to cause reduced fertility in animal studies.
- It is not known whether anthracene crosses into the placenta or leaches into breast milk.

### Recommendations

- Wear gloves and eye protection when working with anthracene.
- Nitrile gloves offer good resistance to anthracene.
- Avoid direct exposure.



<https://ehs.princeton.edu/>

40

40

## Princeton EHS Process



- Discuss recommendations with PI, supervisor, others
- Provide tips for discussing with others in the lab
- Consider options

Fig. 1: Questions raised during pregnancy.  
From: [Pregnancy in the lab](#)



<https://ehs.princeton.edu/>

<https://www.nature.com/articles/s41570-022-00362-0/figures/1>

41

41

## Pregnancy and Stress

- Consider mental health, not just laboratory risk



<https://ehs.princeton.edu/>

42

42



## Audience Survey Question

ANSWER THE QUESTION ON THE INTERACTIVE SCREEN IN ONE MOMENT

### Do you know who would consult about reproductive health issues in your lab?

- **A)** I would avoid discussing this concern with people in the lab, as it might impact their perception of my commitment to the group's work
- **B)** I am comfortable discussing this issue with my co-workers, but I wouldn't want to bring it to the attention of laboratory management
- **C)** I have discussed this issue with our laboratory manager and we share a common understanding of potential concerns
- **D)** I have reviewed my institution's reproductive health policies and support services and understand my rights and responsibilities in this regard

\* If your answer differs greatly from the choices above **tell us in the questions window!**

43

43

## Reproductive Assessments A Clinician Perspective

**Rich Wittman, MD MPH**

Medical Director,

Stanford University Occupational Health Center

[rwittman@stanford.edu](mailto:rwittman@stanford.edu)

**Stanford** | Environmental  
Health & Safety

Stanford University

44

# Practical Toxicology



*All substances are poisons; there is none which is not a poison. The right dose differentiates a poison from a remedy --Paracelsus, 1567*

- 2007: Jury rules against radio station after woman dies in [water drinking contest](#)
- 2012: Tragic case involving 12-year-old girl following a game of "[water poker](#)"

## Precautionary Principle

- Protective actions can and should be taken before definitive proof has been established of potential harm from use of any chemical with suspected toxic impacts on human or environmental health
- In 2003, San Francisco became the first U.S. city to adopt a Precautionary Principle ordinance:

*"Where threats of serious or irreversible damage to people or nature exist, lack of full scientific certainty about cause and effect shall not be viewed as sufficient reason for the City to postpone cost effective measures to prevent the degradation of the environment or protect the health of its citizens. Any gaps in scientific data uncovered by the examination of alternatives will provide a guidepost for future research but will not prevent protective action being taken by the City. As new scientific data become available, the City will review its decisions and make adjustments when warranted."*

## Risk Stratification

- Where does this leave us? Relying on common sense and pragmatism or worried/concerned?



Rick

Water Drinking Contest - <https://abcnews.go.com/GMA/jury-rules-radio-station-jennifer-strange-water-drinking/story?id=8970712>  
Water Poker - [https://www.upi.com/Top\\_News/World-News/2012/07/06/Girl-dies-from-consuming-too-much-water/UPI-38071341807754/](https://www.upi.com/Top_News/World-News/2012/07/06/Girl-dies-from-consuming-too-much-water/UPI-38071341807754/)

45

45

# Describe the potential hazards present?



- A) Respiratory
- B) Dermal
- C) Ergonomic
- D) Noise / Vibration
- E) Emotional Stress



Rick

<https://www.uib.no/en/rg/animalfacility/114106/gas-anesthesia-and-safety-issues>

46

46



# Risk Stratification: Questions to Consider

## 1. What is the end point? 2. What is the outcome of interest?

- Acute or chronic?

## 3. Contributing Factors

- Exposure Frequency and Chronicity
  - Daily activity versus sporadic or unique?
- Potential Routes and types of exposure
  - Respiratory vs dermal vs oral; fume vs dust vs liquid
- Lab Conditions
  - Local ventilation
  - PPE availability: Selection and compliance
- Personal risk factors
  - Age, underlying medical conditions, nutritional status

Chemical Resistance Selection Chart for Protective Gloves

Chemical	Neoprene Latex/Rubber	Butyl	Nitrile
Acetaldehyde*	VG	G	VG
Acetic acid	VG	VG	VG
Acetone*	G	VG	VG
Ammonium hydroxide	VG	VG	VG
Amy acetate*	F	P	F
Aniline	G	F	F
Benzaldehyde*	F	F	G
Benzene*	P	P	P
Butyl acetate	G	F	F
Butyl alcohol	VG	VG	VG
Carbon disulfide	F	F	F
Carbon tetrachloride*	F	P	G
Castor oil	F	P	VG
Chlorobenzene*	F	P	P
Chloroform*	G	P	P
Chloronaphthalene	F	P	F
Chromic acid (50%)	F	P	F
Citric acid (10%)	VG	VG	VG
Cyclohexanol	G	F	VG
Dibutyl phthalate*	G	P	G
Diesel fuel	G	P	VG
Diisobutyl ketone	P	F	P
Dimethylformamide	F	F	G
Diethyl phthalate	G	P	VG
Dioxane	VG	G	G

## 4. Prevention requires a baseline awareness of the potential hazard, toxic or otherwise

- [Soda and diabetes](#), [Bleach and ammonia](#), [Arsenic and brown rice](#) (and [this](#) or [this](#))



Rick

<https://www.osha.gov/sites/default/files/publications/osha3151.pdf>

47

47

# Health Impacts: Lead Exposure

## • During pregnancy

- Lead crosses placenta in plasma (1% of circulating maternal levels) most notably at 12-14 weeks
  - Miscarriage (BLL > 5.0), stillbirths; for men: oligospermia, loss of libido
- Fetal lead exposure has an [adverse effect](#) on neurodevelopment
  - *In utero exposure* (maternal BLL 14): lower birth weight, neural tube defects, neuropsych effects
  - May be most pronounced in the first trimester

## – Childhood impact

- Deficits in cognitive and academic skills associated with lead exposure occur at blood lead levels < 5 µg/dL ([Lanphear et al. Public Health Reports 2000 \(115\): 521-529](#))
  - This includes diminished learning ability, memory, auditory and language processing
  - Aggression, hyperactivity, antisocial behaviors, impulsivity, distractibility
- Persist after controlling for SES, race, region. [These effects persist](#) through high school
  - [No safe blood lead levels](#) in children have been identified

## • Later in life

- Impact from lead mobilization due to osteoporotic bone resorption
  - 1996 study compared women (mean age 70.5 years) with BLL >8 µg/dl and BLL <3 µg/dl ([Muldoon SB, Cauley JA, Kuller LH, et al. 1996. Effects of blood lead levels on cognitive function of older women. Neuroepidemiology 15:62-72](#))
    - » Slower reaction times
    - » Poorer performance on cognitive measures



Rick

48

48



## Reproductive Health Assessments: Barriers to Reporting

### DISCLOSURE BARRIERS

- **Concerned about adverse impact on job**
  - Short-term
    - » Viewed as working less or being less devoted to job
    - » Increased workload for coworkers
  - Longer-term
    - » Passed over for projects, promotions, salary raises
    - » Perception that will not be around due to childcare obligations or 2<sup>nd</sup> child/pregnancy
- **Personal intrusion**
  - Coworkers knowing private matters
  - Want to wait until pregnancy clearly progressing, without miscarriage
- **Guilt**
  - **Dual-sided:** Supervisor and employee/student
- Unaware or unanticipated pregnancy

### PROCESS BARRIERS

- Program or risk information not easily available
  - Unclear if confidential path for workplace reporting
- Concerned about job removal if report



49

49

## Reproductive Health Assessments: Role of the Occupational Health Clinician

### Trained in Hazard Identification

- Heavy metals / Organic Solvents / Anesthetic Gases
- Radiation/ noise / heat stress
- Ergonomics and musculoskeletal injury / Work stress
- Infectious disease risks / animal allergy

### Facilitator

- EH&S: Risk-reduction and planning
  - PPE selection: [Gloves](#) and Respirators
- Personal physicians and specialists
- Absence Management, Risk Management

### Clinically trained, working in healthcare setting

- Confidential resource
- Cannot disclose without authorization

### What will I come away with?

- **Certainty:** Advocate and support
- **Uncertainty:** Scientific literature does not have all the answers
- Medical perspective and resource for questions



50

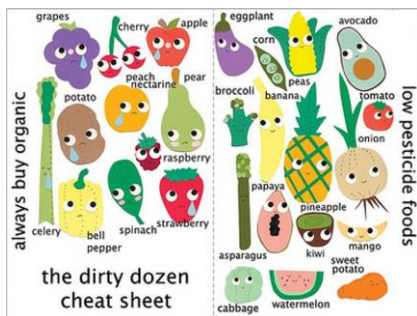
50

## Reproductive Health Assessments: Role of the Individual



## Be your own advocate at work

- Most programs do not proactively address reproductive safety and health
- Seek out advice and guidance (EH&S, MDs, PI, internet)



## Evaluate your risks outside of the workplace

- **Infectious disease**
  - Up-to-date on vaccinations (flu, COVID)
- **Diet and nutrition**
  - Sugar intake / diabetes risk
  - Heavy metal exposure
    - » Wash/soak/rinse rice
    - » Test home water for lead; consider filtering water
    - » Limit consumption of larger, predator fish
  - Eat organic, or organic-equivalent, meat
- **Pesticides**
  - Buy organic as possible for higher-risk fruit and vegetables ([article](#))
- **Endocrine disruptors**
  - Lotions, perfumes, sunscreens
- **Minimize alcohol intake / smoking / 2<sup>nd</sup>-hand smoke**
- **Exercise**



Rick

<http://www.fitsugar.com/Pocket-Guide-What-Buy-Organic-8274490>

51

51



## Audience Survey Question

ANSWER THE QUESTION ON THE INTERACTIVE SCREEN IN ONE MOMENT

**If you became involved in a pregnancy, either as a pregnant person yourself or as the partner of a pregnant person, who would you consult for further information?**

- A) I would review the relevant scientific literature
- B) I would talk with my supervisor about the situation
- C) I would talk with EHS staff about this issue
- D) I would talk with occupational or general medical professionals about this issue
- E) I would work with the obstetrician involved in the care of the pregnancy to assess any concerns

\* If your answer differs greatly from the choices above **tell us in the questions window!**

55

55

## 2021-2022 References on the Topic



- **A Call for Increased Focus on Reproductive Health within Lab Safety Culture**  
Catherine P. McGeough,<sup>†</sup> Sarah Jane Mear,<sup>†</sup> and Timothy F. Jamison\*  
<https://pubs.acs.org/doi/10.1021/jacs.1c03725>
- **What to Expect When Expecting in Lab: A Review of Unique Risks and Resources for Pregnant Researchers in the Chemical Laboratory** Mary Kate M. Lane, Mahlet Garedew, Emma C. Deary, Cherish N. Coleman, Melissa M. Ahrens-Viquez, Hanno C. Erythropel, Julie B. Zimmerman, and Paul T. Anastas\*  
<https://pubs.acs.org/doi/10.1021/acs.chemrestox.1c00380>
- **Pregnancy in the lab**; Anna Slater 1, Claudia Caltagirone 2, Emily Draper 3, Nathalie Busschaert 4, Kristin Hutchins 5 and Jennifer Leigh 6 ✉ Nature reviews | **Chemistry** <https://www.nature.com/articles/s41570-022-00362-0>
- **Mom the Chemistry Professor** from ACS Women Chemists Committee <https://www.worldcat.org/title/mom-the-chemistry-professor-personal-accounts-and-advice-from-chemistry-professors-who-are-mothers/oclc/1046977803>



Ralph

56

56

## ACS CHAS Led Peer Workshop



### Empowering Academic Researchers to Strengthen Safety Culture



**Led by Adelina Oronova, Michigan Technological University and Omar Leon Ruiz, University of California, Los Angeles**

**Sunday, October 9, 2022 2 – 5:30 PM**

Registration for this workshop is \$25 per participant.

This **workshop** is directed at frontline researchers in academic institutions: **graduate students, postdoctoral scholars, and undergraduate students**. Faculty and safety staff are also very much encouraged to participate.

**Workshop Goals:**

- Educate participants about the value of risk assessment
- Guide participants towards gaining awareness of safety culture messages from leadership at their institutions
- Empower participants to expand their safety networks and develop laboratory safety teams



Ralph

<http://dchas.org>

57

57