

# Health Effects of Early-Life Exposure to Air Pollution

- Babies are not just little adults -

Barbara Hoffmann  
Heinrich Heine University Düsseldorf

HEI Annual Conference  
Seattle, 2019

# Aging and Disease

Neurodegenerative  
disease



Cardiovascular  
disease



Respiratory disease



Metabolic disease



**institut**

arbeitsmedizin  
sozialmedizin &  
umweltmedizin

# Aging and Disease



# Aging and Disease



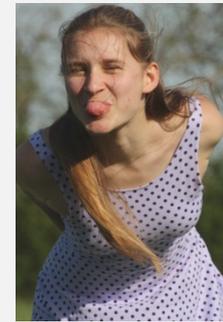
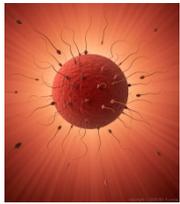
**Initiation and progression of disease**



# What is \*Early Life\*?

Before!

Conception    Pregnancy    Birth    Infancy    Childhood    Adolescence



Adulthood  
Old Age

Life course

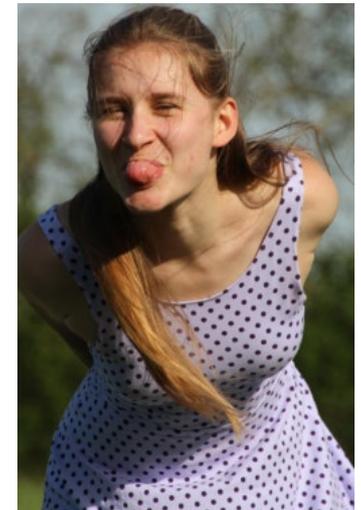
# Important developments in \*Early Life\*

Organ development and growth -----

Priming immune system

Reduced function

Clinical disease



# Examination of critical time windows

- More complex spatio-temporal models necessary
- Uncertainty regarding time of conception
- High correlation of exposure (e.g. prenatal and postnatal)
- Intergenerational and transgenerational effects (via the epigenome): exposure of parents and grandparents

# Popular outcomes in \*Early Life\* epidemiology

Measures of ...

- **intrauterine growth** – low birth weight (LBW), head circumference, small for gestational age (SGA)
- **prenatal pathologies** – preterm birth



- Low birth weight, preterm delivery and their relevance for later life
- Biologic mechanisms
- Overview of the epidemiological evidence
- Study design challenges
  - Multiple exposures
  - Timing of exposure
- Research gaps

UNIVERSITY OF COPENHAGEN

## Epidemiological Evidence for Adverse Birth Effects Associated with Prenatal Exposure to Air Pollution



Marie Pedersen

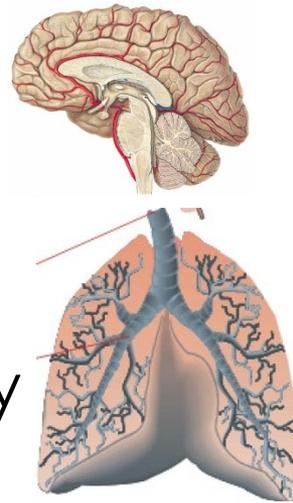
Department of Public Health, University of Copenhagen  
Danish Cancer Society Research Center, Denmark

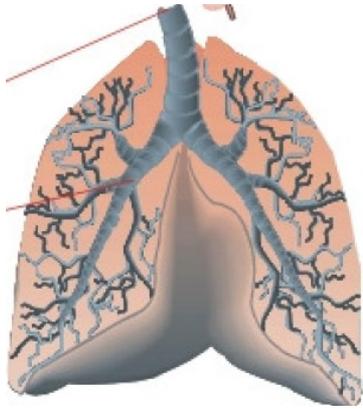


# Popular outcomes in \*Early Life\* epidemiology

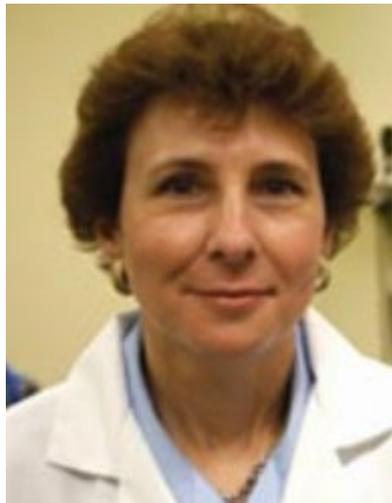
Measures of ...

- **intrauterine growth** – LBW, head circumference, SGA
- **prenatal pathologies** – preterm birth
- **organ development** – lung volumes, brain MRI
- **functional capacity** – cognitive function, insulin secretion
- **subclinical pathologies** – airway hyperreactivity  
insulin resistance
- **disease** – asthma, autism, obesity, diabetes mellitus

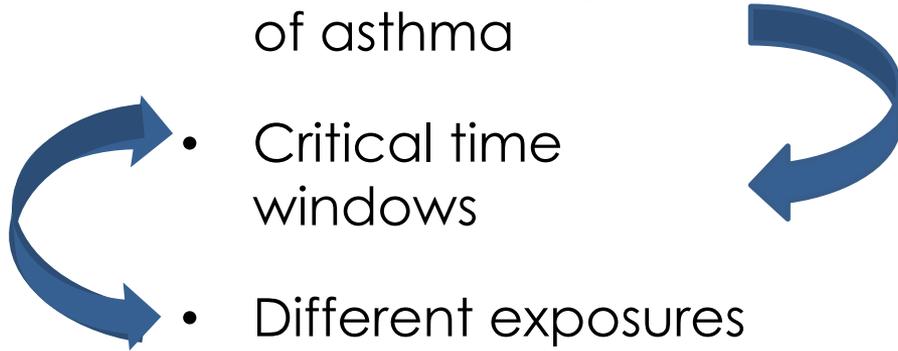




# Respiratory Effects and Asthma in Children – Rosalind Wright



- From lung function development to manifest disease
- Programming and onset of asthma
- Critical time windows
- Different exposures
- Differences by socioeconomic status





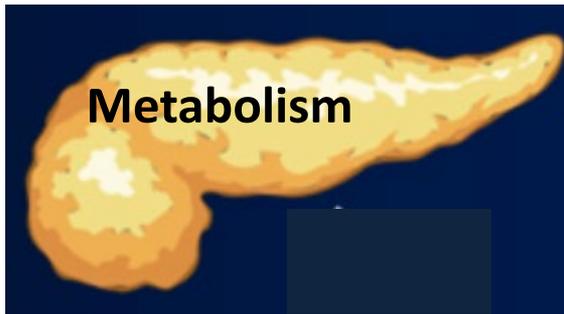
Sharon Sagiv

- Explain different outcomes and their assessment methods
- Novel outcomes
- Etiology and critical time windows
- Biological plausibility

## AIR POLLUTION AND NEURODEVELOPMENT

---





- Relevance of the outcomes for later disease
- Critical time windows and biology
- Vulnerable groups

## Obesity and Type 2 Diabetes in Children

Health Effects of Early-Life Exposure to Air Pollution  
HEI 2019 Annual Conference

**Tanya L. Alderete, Ph.D.**  
Assistant Professor  
Department of Integrative Physiology  
University of Colorado at Boulder



# \*Early Life\* effects

- Children are not just little adults – developing organism, different physiology, different exposures and exposure pathways
- Special attention to critical time windows, methodologically challenging
- Effects of early life exposure can have long-term consequences – up to 100 years or more!
- Underestimation of true burden of disease

# Ongoing studies – take a look at the posters

- Marie Pedersen
- Payam Dadvand, Jordi Sunyer
- Monica Guxens
- Meredith Franklin

# Thank you



email: [b.hoffmann@uni-duesseldorf.de](mailto:b.hoffmann@uni-duesseldorf.de)  
phone: +49-211-586 729 110

8:00 Introduction

*Barbara Hoffmann*

8:10 Adverse Birth Effects

*Marie Pedersen, University of Copenhagen, Denmark*

8:35 Respiratory Effects and Asthma in Children

*Rosalind Wright, Icahn School of Medicine at Mount Sinai*

9:00 Neurodevelopmental Effects

*Sharon Sagiv, University of California, Berkeley*

9:25 Obesity and Type 2 Diabetes in Children

*Tanya Alderete, University of Colorado, Boulder*



**institut**

arbeitsmedizin  
sozialmedizin &  
umweltmedizin

---

# Environmental influences during the life course

## Pregnancy - Infancy - Childhood

## Adulthood - Old Age

